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...LECTURE UPON...

Metallic Interstitial Electrolysis.

—BY—

AUGUSTIN H. GOELET, M. D.

[Delivered in the Course of Clinical Instruction in
Gynæcological Electro-Therapeutics at the
West Side German Clinic, New York.]

REPRINTED FROM

"THE TIMES AND REGISTER."

LECTURE UPON METALLIC INTERSTITIAL ELECTROLYSIS.

By AUGUSTIN H. GOELET, M. D.

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IN 1891* my friend and colleague Dr. Gautier of Paris suggested a novel method of electro-chemical medication which he designated *interstitial* electrolysis. It consisted in the application of a solution of iodide of potassium which was decomposed by the action of the current and either iodine or potassium was liberated according to the pole upon which it was employed. The purpose of this was to increase the antiseptic and germicidal power of the current at the poles. It is well understood that this effect is obtained only at the positive pole with the ordinary method of using the current, and that only when a strength of current is used which is rarely tolerated easily.

Gautier instituted experiments which demonstrated the positive germicidal power of both poles when a solution of iodide of potassium is employed with a current strength of only 25 m. He further demonstrated the fact that this action is not limited merely to the surface in contact with the electrode but that it penetrates to some distance beneath the surface. That, in other words, the action is interstitial.

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*A translation of Dr. Gautier's publication may be found in the Archives of Gynæcology etc., for Aug. 1891, page 439.

He applied this method to the treatment of keloids, lupus, ulcerations, cysts, hydrocele, varicocele, chancres, buboes, etc., and to urethritis and endometritis as well with marked success. In the female urethra he used the positive pole with 25 m. and in the uterine canal the negative pole with 50 m. In both instances he employed an applicator made of platinum, which was wrapped with absorbent cotton and dipped into a solution of iodide of potassium, having a strength of one to ten parts of water.

About the same time or possibly before, Prochownick published the details of of another method of enhancing the germicidal properties of the positive pole. He employed as an electrode a copper sound with that pole. He applied it first to the cervical canal in a case of gonorrheal infection, using a current strength of 80 to 100 m. for ten minutes, and noticed that the gonococci disappeared and the discharge became serous after three applications.

To Gautier, however, is due the credit

of developing and popularizing this method of application, which he designates a form of interstitial electrolysis.

A more comprehensive term is metallic electrolysis; since the action depends; upon the electro-chemical decomposition of the metal employed as an electrode. You will understand of course that this action can take place only at the positive pole, since it is here that the oxygen, chlorine and acids which act upon the metal, congregate, so to speak.

Instead of a chemical decomposition of the tissues in contact with the electrode, which occurs when a non-attackable metal, such as platinum or gold or carbon is employed, the metal is acted upon and the formation of an oxy-chloride of copper is the result. That is, the decomposition liberates upon the surface of the electrode, and consequently upon the tissues in contact with it, this salt of copper; which has an apple-green color and is insoluble. As soon as formed this salt is driven into the tissues beneath the surface, by an electrical osmosis or cataphoresis, as one of the direct effects of the current. This was very clearly demonstrated by Gautier, in his experiments upon the uteri of rabbits which had been submitted to the electrolysis of copper. The tissues for a considerable distance were stained an apple-green color. He tact of the electrode, the extent of the action can be very nicely and accurately varied.

This you have seen demonstrated repeatedly here in this clinic, when the electrode in some cases is allowed to remain in one position for five or ten minutes, and in other cases it has been kept moving over the surface.

The action upon the metal occurs very quickly, and this reminds me to warn you that when copper or iron is employed the electrode will become adherent, and it is sometimes quite difficult to remove it when the application is being made to cavities. Gautier suggested that the poles be reversed for a few minutes after the application is completed, in order to facilitate the withdrawal of the electrode, the action of the negative pole having the effect of loosening it. I have found this to be seldom necessary, however, if the electrode be carefully rotated upon its axis before any attempt is made to withdraw it.

Great improvements have been made in this method since its inauguration by Gautier, and its uses have been greatly extended. He recommended using a current strength of 30 to 80 m. and prolonging the application to ten or twenty minutes. This has been found unnecessary and undesirable in many instances; so that now a strength of 20 to 30 m. is rarely exceeded, and the duration has been limited to five or ten minutes, and even a shorter period is often more desirable. It is often better to keep the electrode in constant motion over the surface upon which it is desired to obtain the action. Much depends upon the surface to which it is applied and the condition with which you have to deal, as you have observed in the cases you have seen treated in this clinic.

To enumerate some of the uses to which this method of electro-chemical application with copper can be put, uterine hemorrhage, endometritis, urethritis, and ulcerating surfaces may be mentioned as having been suggested by Gautier. My friend, Prof. W. J. Morton, has very clearly demonstrated its usefulness in certain conditions where it had not been thought of before. For instance he has employed it quite satisfactorily in hæmorrhoids, and ulcers of the rectum, using from 10 to 25 m. for five or ten minutes. In hemorrhoids, though applied to the surface, no irritation is provoked, and the tumor immediately shrivels up and gradually subsides. In some instances, the tumor has been punctured with copper needles and the current employed through them, liberating the oxy-chloride of copper within, with very encouraging results. He has also employed it with great satisfaction in the treatment of both atrophic and hypertrophic rhinitis, using 10 to 15 m., and keeping the electrode moving to avoid sticking. He has attained the most signal success with it in the treatment of trachoma. In this condition a strength of only 2 m. is used, and the electrode is kept moving over the surface for only a minute at each sitting. Some of the most obstinate and unpromising cases have been cured in this manner after five applications.

I have employed cupric electrolysis extensively in the treatment of hemorrhage from the uterus and in endometritis, and have been very well satisfied with the results. In uncomplicated uterine hemorrhage it has no equal, and in endometritis, associated with a softened and relaxed condition of the uterine body, the results have been excellent. It is quite important, however, to be certain that the cervical canal is patulous for subsequent drainage, and this part of the canal should be excluded from the action when possible, to avoid uterine colic, which I have found to result from the treatment when these precautions are not observed.

I am in the habit of employing from 20 to 30 m., for five or ten minutes, for the

control of uterine hemorrhage, and, as you have often observed here in the clinic, it will control the bleeding when every other means have failed. The result is both prompt and permament.

In endometritis I employ from 10 to 15 or 20 m., for a period of five minutes only, and have found this quite sufficient in the majority of cases where it is indicated.

I have used cupric electrolysis also with great satisfaction in fissure of the anus, using from 10 to 15 m. for three to five minutes only, Healing has been accomplished in this manner after only two or at most three applications, without stretching the sphincter. In proctitis there is nothing equal to it. Here a strength of from 10 to 20 m. is used, and the electrode is kept in motion,so the whole surface may be submitted to the action. In ulcer of the rectum this method of treatment likewise yields excellent results. Here the surface may be exposed with a speculum and the action localized where desired.

I have also applied cupric electrolysis to the cavity of vulvo-vaginal cysts, after evacuation, and have thus promptly arrested the secretion and effected rapid healing. It may be utilized in the same manner in the treatment of other cysts also.

The electrodes are made in various shapes and sizes, from an ordinary rod

But I will ask you to pay particular attention to the details, for very much depends upon its proper application. I would advise you to take close notes of the strength, duration and frequency of the application, etc., in the different conditions, as you see them treated, for your future guidance in your practice. In this manner only will it be possible for you to get the same results which you have witnessed here.

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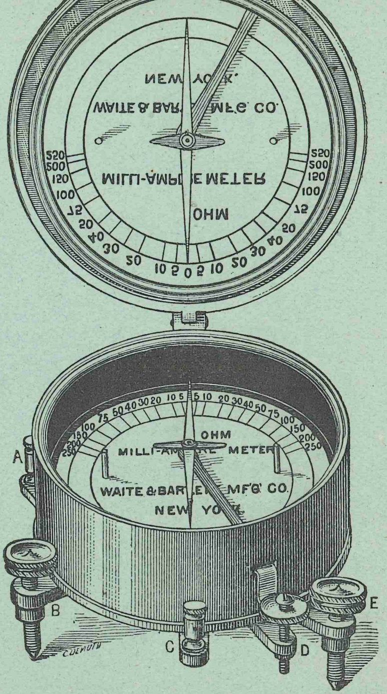
THE THERAPEUTIC VALUE OF ELECTRICITY IN GYNECOLOGY.

A Lecture delivered by invitation, at the New York Polyclinic, May 21, 1889.

BY

AUGUSTIN H. GOELET, M.D.,
OF NEW YORK.

FROM
THE MEDICAL NEWS,
June 22, 1889.



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OF NEW YORK.

GENTLEMEN: I am here to-day by invitation of our friend, Dr. A. M. Jacobus, to give you the benefit of my experience with electricity in gynecology. Of the three forms of electricity, I will confine my remarks to galvanism. It will, of course, be impossible for me to do more than give you a general outline of the principles involved and the methods of administration; but I will endeavor to make my remarks as practical as possible, in order that you may be able to make use of them in cases arising in your every-day practice.

We recognize in gynecology a distinct active and inactive pole; the active pole being that pole applied to the internal surface of the body, in the vagina, within the uterus, or into the tissues by puncture. It is from this pole that we expect our effect. The inactive pole is that pole applied to the external surface of the body, having for its object only the completion of the circuit. From this we expect no effect, and we get none, if we except the mild counter-irritation produced by the hyperæmia of the surface which occurs under the pad when strong currents are used. You will understand, then, that either the positive or the negative pole of the battery may be the active pole, according to your selection.

It is very important for you to understand that the difference in the therapeutic action of the two poles is as great as the difference in their chemical action. You know, of course, that oxygen is generated at the positive pole, and hydrogen at the negative pole; that the positive pole attracts acids from the tissues, while the negative attracts alkalies. In a general way, the positive pole is known as the coagulating pole, while the negative is the liquefying or fluidifying pole. But there is a distinct polar and inter-polar action of the current, the polar action being that action which takes place at the point of contact of the active pole with the tissues, and the inter-polar action being the influence exerted by the current in its passage through the tissues, the greatest action being manifested in proximity to the active pole. These different actions may be more readily appreciated by you, and will be more convenient for you in every way, if they are put in tabular form, and for that reason I have had them written out on the black-board for your future guidance. The positive pole may, then, be divided into its inter-polar and polar action. In its inter-polar action it is *anodyne*, *sedative*, *anti-congestive*, *denutritive*, *anti-hemorrhagic* or *hæmostatic*, and *alterative*. It acts by contracting the capillaries, will drive out congestion, allay inflammation, and will relieve pain. In its polar or local action it is *styptic* with moderate intensities, and *caustic* and *hæmostatic* with high intensities. As I have said before, it is the coagulating pole, and it is, therefore, useful for arresting hemorrhage when applied intra-uterine. The negative pole in its inter-polar action is *stimulating*, *congestive*, *derivative*, and *alterative*, favoring absorption by increasing the blood-supply. In its polar action it is markedly *electrolytic*, *liquefying*, producing active chemical decomposition, and *caustic* with much lower intensities than the other pole. It is particularly useful in removing obstructions in the cervical canal with moderate intensities, having even with low intensities a decided electrolytic effect.

I have said that the negative pole is the caustic pole. It is, in fact, generally known as the more caustic pole, but it is so only when we refer to the bare or unprotected electrode used within the uterus. I have found that with the protected electrode used in the vagina the positive pole is the more caustic—that is, I have been able to use, in cases which were suitable for it, 200 milliampères with the negative pole in the vagina for five minutes without a caustic effect, whereas, with the positive pole it is impossible to use in the vagina 100 milliampères for the same length of time without producing active cauterization. When a current of that strength is used, I advise that the electrode be dipped in a solution of bicarbonate of soda, which will neutralize the acids that collect at the point of contact and prevent the usual caustic action. The different local actions of the poles may be modified or varied at the will of the operator, by increasing or diminishing the current, or by lengthening or shortening the duration of the application.

You have in electricity, as you will see, an agent capable of exerting a remedial influence over almost every form of disease of the pelvic organs, an agent possessing an infinite capacity for modification, according to the method of its application. In this respect it reminds me of a certain musical instrument, the cornet, which, though it has only three keys, may be made to produce any note at the will of the musician.

An intelligent interpretation of these different actions of the two poles of the battery, forms the basis of electrical treatment, and you must constantly bear them in mind. Experience will, of course, increase your ability for a proper selection of the pole to be used. Take my advice and do not attempt the application of electricity to diseases of the pelvic organs until you have thoroughly mastered the subject—until you are able to apply it with a definite object in view. Make up your mind accurately as to the condition present, and apply the remedy so as to meet the indication. In this way alone can the value of electricity be determined and its future usefulness be advanced, for failure from improper use, by those who do not understand it, is more likely to be attributed to the inefficiency of the agent than to inexperience in manipulation. *Ignorance is the greatest enemy of progress.* And this especially applies to the use of electricity. If you will take the trouble to investigate the subject, you will find that the opponents of electricity are those who are utterly ignorant of its action and uses. Those who have pretended to investigate the subject with a view of determining its value, have done so under protest, knowing nothing about it, rather desiring its failure than its success, and, failing, they have damned the agent instead of themselves. See that your failures do not produce the same effect.

Now, the position of the electrodes is sometimes of great importance. When you desire the inter-polar influence of the current you must place your internal electrode and your external electrode in such relation to each other that the tissues under consideration or treatment will be immediately included between the two poles; that is to say, if you are treating the diseased condition of one side of the pelvis, place your vaginal electrode at the most accessible place on that side of the vagina, and your external electrode on that side of the abdomen, thus concentrating your current to one side rather than disperse it over the whole surface of the abdomen externally, for by this dispersion you would lose much of the current as well as the effect. In like manner, if it is more convenient to place the external electrode on the lower part of the spine the position must be such that the diseased structures will be included between the two poles. For electricity in passing from one pole to the other to complete the circuit, will, as a rule, take the most direct route. But when you desire only the local action of the active pole the position of the external electrode is a matter of indifference.

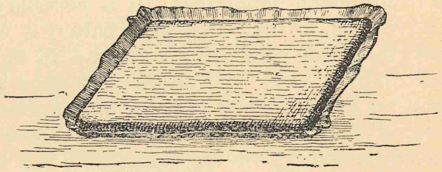
The intensity of the current to be used varies with the condition present and the object to be attained. This, with the duration and frequency of the applications, must be learned by clinical experience. It would be impossible to outline definitely here the intensity of the current and the duration of the application necessary in every case, but in studying each condition I will endeavor to indicate this to you clearly.

As to the meter, this is always a necessity to insure accuracy. Would you think of giving a dangerous drug without knowing accurately the dose you were administering? The meter is necessary not only to insure the safety of the patient, but in order that you may know certainly what you are accomplishing or what you are doing. Do not think that you can work without one, for it is a matter of too much importance. It is necessary, if for no other reason, to show that your battery is working properly, that your conducting cords are all right, and your electrodes in order, and above all, to show that the patient is not deceiving you as to her impressions.

In regard to the form of battery. In my experience the Leclanché apparatus gives the most steady and satisfactory current, but all of you may not be able to possess a cabinet battery of Leclanché cells, and if you select an acid battery, choose one with small elements. The batteries with large elements produce too furious an action—too caustic an action—besides being unpleasant to the patient in the increasing of the current cell by cell. The number of cells may be increased by means of the winch apparatus—that is, the keyboard is fitted with the winch or crank for increasing the current[1]—for the plug and socket arrangement is too inconvenient for the operator and too unpleasant for the patient. Although they may have a double cord to prevent an interruption or break in the current, the patient still feels the increase of each cell more perceptibly than she does from a winch battery.

Of the apparatus for the administration of electricity I will begin by showing you the external electrode. So far as my experience goes the clay pad of Apostoli, with certain modifications, is the best which I have used. The objections that have been made to it, that it is unclean, unwieldy, and uncomfortable to the patient, may be readily overcome by these modifications which I have made. The large size usually recommended for these applications is by no means necessary, except when very high intensities are used, as in the puncture of fibroid tumors. Smaller sizes are more convenient and as readily acceptable to the patient. For instance, the size which I show you, six by eight inches, may be used with a hundred milliampères of current without producing any inconvenient or unpleasant action upon the skin, and even smaller sizes than this may be used for smaller currents. This is made of ordinary potter's or moulder's clay rolled out with a rolling-pin upon a flat surface after having been first mixed to the consistency of putty. It must be perfectly smooth and of a uniform thickness. In an electrode of this size it may be three-quarters of an inch thick. It is then cut into the desired size and shape and a metallic plate with binding-post attached pressed into the back of the pad—merely pressed into the clay, not imbedded. It is covered with a layer of absorbent cotton, taking care to have the binding-post penetrating this and the other layers. It is then sewed up in linen crash, the seam always being on the back of the electrode, so that the surface to be applied to the skin may have no unevenness and be perfectly smooth. Afterward it is backed with rubber cloth, which prevents wetting the clothing of the patient. The absorbent cotton, beside serving to keep the clay moist when not in use, forms a protection which prevents the clay from oozing through and soiling the surface to which it is applied. This may be kept warm in an ordinary pan over a small oil lamp and the unpleasantness of the ordinary cold clay pad avoided. For the sake of convenience I prefer in some of the pads to have the connecting post at the end, which allows it to be slipped up under the clothing and avoids the necessity of loosening the clothes. In applying electricity with a view to its inter-polar action it is often desirable that the size of the external electrode should be limited as much as possible, or as much as the sensation of the patient will allow without inconvenience, in order to concentrate its action.

FIG. 1.



The external clay electrode, showing surface to be applied to the skin.

The ordinary vaginal electrode I do not use at all, because it cannot be protected so as to prevent a caustic action upon the mucous surface. This is on account of the size of the ball and the metal of which it is made. I use with the negative pole a flat metallic disk, a little smaller than the ordinary penny, and this I cover with potters' clay moulded round it. Then I cover it with a very thin layer of absorbent cotton, which, in its turn, is covered by absorbent gauze held in position with a rubber band round the shaft of the electrode. This is used with the negative pole only and is easily kept moist. I have been able to use with the negative pole from fifty to two hundred milliampères through the vagina with this electrode. It would not do to use this electrode with the positive pole because of the metal, which would be corroded by the acids after a few applications, perhaps after the first. I therefore use with the positive pole an electrode with a disk made of carbon, which is not affected by acids. But the connection with the metallic rod of the handle must be removed sufficiently far away from the disk to prevent corrosive action at the point of contact with the carbon, which would interfere eventually with the passage of the current. In this electrode the connection is at least an inch and a half or two inches away from the disk. The carbon tip consists of a disk with a spindle at least two inches in length. This I cover in the same way with potters' clay, absorbent cotton, and gauze, and it may then be used either with the positive or the negative pole. At the same time, however, it is intended more particularly for the positive pole. When it is to be used, an additional covering of absorbent cotton is placed upon it and moistened. After it has been used once this outer layer of cotton is removed and replaced by a fresh piece for the next application. But the carbon is such a good conductor of the current that you are apt to get more caustic action than you would from a metallic electrode of poorer conducting quality, and for this reason, with currents of more than fifty milliampères, I dip the electrode in a solution of bicarbonate of soda previous to its being used.

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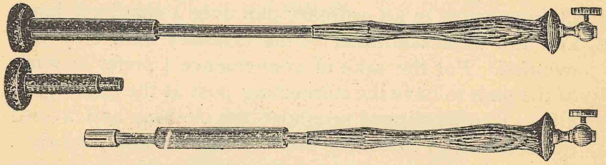
[1] This does not refer to the Waite & Bartlett battery.

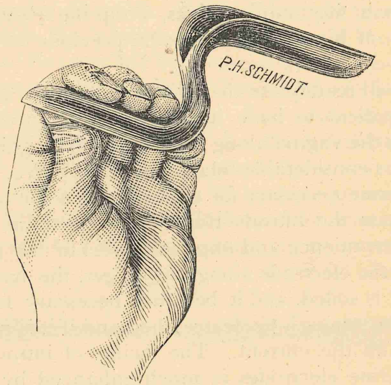
FIG. 2.



The carbon-tipped vaginal electrode.

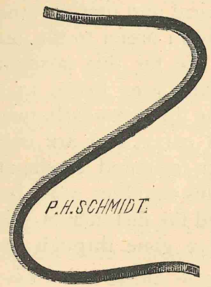
You will readily see that it would be very unpleasant to the patient to have introduced an electrode of this size into the vagina along the finger as a guide unless there was considerable relaxation of the vulva. It therefore became necessary for me to devise some instrument to facilitate the introduction of the electrode. Besides the inconvenience and unpleasantness to the patient of passing the electrode along the finger, the hand of the operator is soiled, and it becomes necessary for him to delay long enough to cleanse the hand if it is needed for turning on the current. The facility of introduction of intra-uterine electrodes is much enhanced by exposing the cervix to view, and is to be preferred to the method of introduction along the finger as a guide, both because it allows more delicate manipulation, and because it is safer for the patient. To overcome these difficulties I have devised the instrument which I show you. It is a modification of the Sims speculum. Of course, when your patients may be placed in the lateral position for applications, the Sims instrument would answer, but when the applications are to be made in the dorsal position the Sims speculum would be unsuitable, and the ordinary bivalve instruments in use do not permit sufficient expansion at the vulva to allow the introduction of this electrode without considerable inconvenience to the patient.

FIG. 3.



The speculum.

FIG. 4.

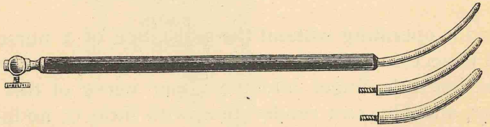


Elevator for the anterior vaginal wall.

This instrument, as you see, consists of two Sims blades joined together by a very short shank and in opposite directions, forming the shape of the letter S. It may be used in either the dorsal or the lateral positions. When used in the lateral position in place of the Sims instrument, it is more readily held by the nurse as well as by the physician. It is more convenient for the physician if he is using it without a nurse than the Sims instrument. It is self-retaining without the support of the hand. In the dorsal position it may be used likewise without a nurse or without any assistance from a depressor unless there is unusual relaxation of the anterior vaginal wall, and, when this interferes with a view of the cervix, I use what I call an elevator of the anterior vaginal wall. It is made of hard rubber and curved in an S shape, so that it may fit over the pubis and be held with one finger of the nurse. If the physician is operating without the assistance of a nurse, all that is necessary for him to do is to ask the patient to hook her little finger into the upper curve of this elevator, and she can render him, with little or no inconvenience, all the assistance he requires. When used in the dorsal position, the speculum is held by the physician in the left hand and the retraction of the perineum is done by him. In order to get this left hand out of the way I usually pass it between the right foot and buttock of the patient, and in that way hold the speculum. In my every-day practice I have come to rely upon this instrument, and use it in preference to the Sims. The advantages of a speculum of this construction are so numerous that, although I have always four or five of the Sims instruments on my table, I continually find myself turning to this for any work that I have in hand. It is now made of hard rubber as well as metal, to avoid the necessity of withdrawing it during the application.

For use with the negative pole almost any metal will be suitable for the electrode if the surface is kept clean and bright. Usually they are made of brass or copper, nickel plated. For use with the negative pole for applications to the cervical and uterine canal, I have devised an instrument which I prefer to the ordinary bulb electrode in general use for this position. It consists of three metal tips, their sizes being 13, 15, and 17 of the French scale. The tips are nearly two and a half inches long, of the usual curve, and are conical at the point. They screw into an insulated handle at a decided shoulder. I consider this shoulder very important, as, when we have penetrated the distance of this shoulder, we are certain that we have gone through the internal os and we need go no further. In this way we avoid the contact of the tip with the fundus of the uterus. I prefer this, I have said, to the ordinary bulb electrode because it is more easy of introduction and because the current is distributed over a greater surface and you do not get such intensified action at one spot. This is used with the negative pole for flexions and obstructions in the cervical canal. In applications of negative galvanism to the endometrium smaller tips may sometimes be necessary, but ordinarily the smallest sized tip answers every purpose.

FIG. 5.



Electrode for the application of negative galvanism to the cervical canal.

In operating with the positive pole we must have a metal or substance which is not acted upon by acids, and platinum and carbon are the only substances heretofore used for this pole. Aluminium may be left out of the question, as it is too easily acted upon by high intensities with the positive pole. Platinum is very expensive, and carbon is absorbent, and for this reason cannot be rendered thoroughly aseptic. Beside, the carbon electrode must necessarily be straight. I have used for the past six months electrodes made of wrought iron and steel protected by a process of treatment which renders the metal absolutely non-corrosive and non-attackable by acids for a considerable length of time.

I show you here the tip (two and a half inches long) which I use, and have been using since January, and there is, as you see, very little action commencing upon the metal. Electrodes made of this material and treated by this process are so inexpensive that they may be thrown away when there is the slightest sign of corrosion upon them, but they will resist for a long time, and, besides, it is a better conductor of the current than platinum. This electrode, with a tip two and a half inches long, is intended for applications of positive galvanism to the entire uterine canal at once.

When it is desired to make the application only to the cavity of the uterus, it is necessary to have an electrode shorter than this, and for this purpose I have had an electrode made of the same material, three-quarters of an inch in length, which may be screwed into an insulated handle which is curved. This is fashioned after the Apostoli carbon electrode, and, besides the advantage of cleanliness, it is curved, and for that reason may be more easily introduced into the canal. It would be quite impossible to introduce the straight Apostoli carbon electrode into the canal in some cases, and very inconvenient to introduce it in all cases. It is more natural to have an instrument which is of the proper curve, and this can only be done by having a metallic tip upon a curved shaft. This tip should be of different sizes, 12 to 16 French, and the size should be selected with a view to the size of the uterine cavity. A tip should be used which would fit into the uterine cavity so as to be in contact with the whole surface to which it is applied; that is, it should not fit loosely into the uterus. For this reason different sizes are necessary. The tips are made three-quarters of an inch in length, so that the uterine cavity, exclusive of the cervical canal, may be cauterized in two sections. Passing it up to the fundus, it is left there long enough to produce the action you desire, and then it is withdrawn the length of the tip that is marked upon the shaft of the electrode, and the second section is cauterized. When the whole cavity is thus cauterized it may be removed without producing any effect upon the canal of the cervix. This is usually the most sensitive part of the whole canal, and will not tolerate the intensities which may be applied to the cavity, besides, atresia might follow.

I show you here also an ordinary puncturing needle, which is screwed into an insulated shaft or handle. But this is an instrument which I should not advise to be used except by experienced hands—I mean experience in application—for, as you will see, it has no shield or guide to limit the penetration. I would advise beginners (and prefer even myself in many instances) to use a needle with a sliding protection upon the shaft fixed by a screw so that a limit to the amount of penetration may be made. In this way you need not go through the tumor, but stop when you have penetrated it a certain distance, an accident which might occur if you used a needle without this protection.

I show you here an aspirating trocar and canula. This, has a protecting sliding covering of catheter material and a screw adjustment to limit the amount of penetration, and is used for tapping small cysts and hydrosalpinx, and pyosalpinx when accessible through the vagina. I would not have you infer, however, that I

advise its use in all cases. It is, in fact, only applicable in certain conditions. I tap the sac with this trocar and

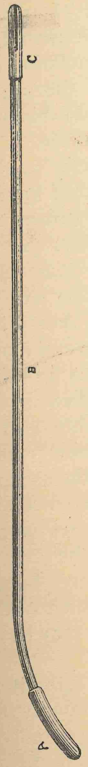


FIG. 6.

Electrode for applications of galvanism to the uterine cavity.

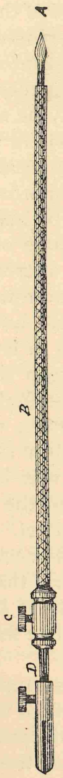


FIG. 7.

Puncture needle with sliding cover to limit penetration.

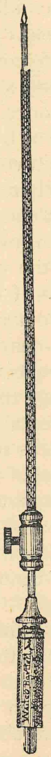


FIG. 8.

Aspirating trocar and canula.

canula, withdraw the trocar, and empty it of the fluid. The trocar is then reintroduced and the attachment made with the battery, with either pole (usually the negative pole is preferred), with the current turned on (from fifty to one hundred milliampères) thus cauterizing the tissues which are penetrated by the canula, and in this way avoiding the chance of the absorption of any septic material. Beside, the action of the current upon the collapsed sac tends to prevent the reaccumulation of the fluid. I seldom find it necessary to tap the sac more than once. While it may be advisable to do this in most cases of hydrosalpinx where easily accessible, it is not always wise to do it for pyosalpinx. I prefer to drain a pyosalpinx through the uterus. Frequently I have been able to accomplish this by applications of strong positive galvanism to the entrance of the tube into the uterus (into the cornua of the uterine cavity on that side), by means of a small platinum-tipped electrode the size of an ordinary uterine sound and not more than a half to three-quarters of an inch in length. In several instances I have been able to drain the pyosalpinx in this way through the uterus intentionally. I first discovered this accidentally after applying a current of a hundred milliampères to the cornua on the diseased side; the withdrawal of the electrode was followed by the escape of a tablespoonful of pus, and the patient experienced immediate and permanent relief. Several times since this accidental discovery I have accomplished the same thing, but I cannot say definitely that it can always be accomplished. When this cannot be accomplished and when the condition is appropriate for it the tube may be tapped through the vagina.

When a pyosalpinx is tapped by the vagina it is best always to wash the cavity of the tube thoroughly through the canula with an antiseptic solution, generally either with an aspirator or with the surgical pump, before the galvanism is applied to the track of the canal. Permanent drainage may be secured through this cauterized drainage track and the cauterization prevents the absorption of septic material in its passage along this opening. The opening remains patulous for several days, usually as long as there is any necessity for drainage. If closure occurs it is an easy matter to pass the trocar again, or a small blunt electrode along the track while connected with the negative pole of the battery. It will work its way along the track made previously and enter the sac, reopening it for drainage.

The diseases which I have found amenable to treatment by galvanism and which have yielded very satisfactorily to the treatment, I may say often more satisfactorily than to any other form of treatment known to me or heretofore used by me, are: Uterine flexions, obstructions in the canal, hypertrophy of the organ, metritis, endometritis, menorrhagia and metrorrhagia, chronic pelvic cellulitis, exudations and adhesions, hæmatoma and hæmatocele, ovaritis and salpingitis, and certain conditions of hydrosalpinx and pyosalpinx.

I have not yet quite made up my mind that electricity is proper for actual stenosis. I prefer to dilate first and maintain the dilatation in the beginning with the intra-uterine stem worn for one week only while the patient is confined to bed, and subsequently by the use of negative galvanism to the canal. In treating flexions and obstructions in the canal we use negative galvanism as a rule, and the strength necessary will vary from ten to fifty milliampères, according to the condition and chronicity of the case. Cases of chronic hypertrophy are likewise treated by negative galvanism. Chronic metritis and endometritis are usually treated with positive galvanism, but there are conditions which call for treatment by the opposite pole. Menorrhagia and metrorrhagia may be treated by positive galvanism with currents varying from fifty to one hundred milliampères used intra-uterine. Chronic pelvic cellulitis, exudations and adhesions of long standing, after all inflammatory action has subsided, yield readily to treatment by negative galvanism by the vagina, and it is in these conditions that I maintain strong currents are required. I frequently reach two hundred milliampères in the treatment of these conditions and find that exudations and adhesions melt away like ice under the rays of the sun. Of course, it would not do to begin the treatment of a case by using such high intensities. Beginning with fifty milliampères, treating the case every second or third day, and gradually increasing the dose, the tolerance of the current may be increased, and the high intensities, when reached, will produce no more discomfort or inconvenience to the patient than the small dose did at the beginning. As the menstrual period approaches if there is a tendency to over-menstruation the intensity must be lowered, and in beginning the treatment again after menstruation a smaller dose must be applied and again gradually increased. Fixation of the pelvic contents is to be treated in the same manner. A good rule to follow is to use positive galvanism in the vagina for its inter-polar action as long as there is any active inflammation, or as long as the vaginal roof is sensitive to ordinary pressure. When the condition is chronic, or when the roof is sensitive only to deep and sudden pressure, negative galvanism is indicated.

Hæmatoma and hæmatocele afford a striking illustration of the prompt remedial influence of electricity. Hemorrhage, in a case seen early, may be controlled to a certainty by positive galvanism applied through the vagina. When the case is seen after hemorrhage has ceased, positive galvanism is indicated to control further hemorrhage, to contract the clot which has formed, and to hasten the separation of the serum. If the separated serum is of considerable quantity and produces pain from pressure, it may be withdrawn by trocar and canula in the same way that I described the withdrawal of the hydrosalpinx, but positive galvanism must be used immediately afterward to contract the capillaries and prevent the recurrence of hemorrhage and to favor the closure of the sac which contains the fluid. Positive galvanism must be used, however, for some time subsequently to produce a still further contraction of the clot, and as soon as all sensitiveness has subsided, and all inflammatory action surrounding the effusion has been subdued, negative galvanism may be applied through the vagina to hasten absorption, or, if the case is an obstinate one, absorption may be hastened by negative galvano-puncture of fifty to one hundred milliampères.

Small cysts and fibro-cysts of the ovary and in the broad ligament frequently yield readily to negative galvano-puncture through the vagina, some of them requiring only one puncture for their complete removal.

Fibroid tumors of the uterus are reduced in size by applications of strong currents by galvano-puncture. The growth of the tumor is arrested, it is lessened very materially in size, and frequently is reduced so much as to give no further inconvenience to the patient. I have been thoroughly satisfied so far with my experiments with electricity in the treatment of fibroid tumors. Very large and hard tumors of long standing yield slowly and demand strong currents, frequently from two hundred and fifty to five hundred milliampères, and, of course, necessitating the use of an anæsthetic. In many of the cases I have been able to puncture at my office and send the patient home in the carriage. I should not care to advise it in all cases. I prefer to put the patient to bed immediately after the operation and keep her there until all unpleasant symptoms have subsided. Where hemorrhage occurs from the uterine cavity in connection with these fibroids, we treat them by positive galvanism to the endometrium, as advised by Apostoli, administering one hundred to one hundred and fifty milliampères, cauterizing the whole uterine cavity.

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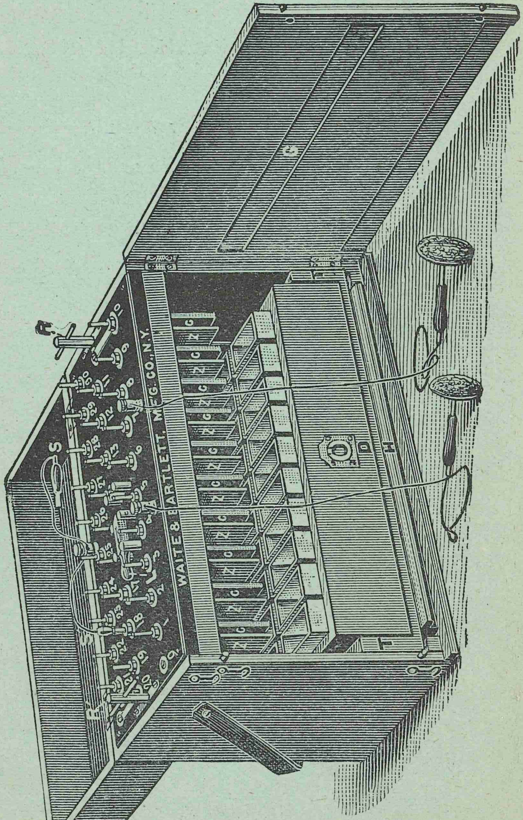
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THE PHYSIOLOGICAL EFFECT AND GENERAL THERAPEUTIC APPLICATION OF PERIODIC INDUCED CURRENTS IN GYNECOLOGY.

BY

AUGUSTIN H. GOELET, M..D

"THE ORMONDE,"
B'WAY, COR. 70TH ST., N. Y.

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Editor American Medico-Surgical Bulletin.

THE PHYSIOLOGICAL EFFECT AND GENERAL THERAPEUTIC APPLICATION OF PERIODIC INDUCED CURRENTS IN GYNECOLOGY.*

By AUGUSTIN H. GOELET, M.D.

PERIODICAL induced currents include the faradic or interrupted induced, the alternating, and the static induced currents, mentioning them in the order of their usefulness. I will say at the outset, to avoid confusion and the necessity of constantly referring to them hereafter, that the alternating and static induced currents are similar in their action to the faradic current derived from the secondary coil of long, fine wire; being high-tension currents—that is, currents possessed of a high degree of e.m.f. and an almost inappreciable volume or amperage. They are also currents of high frequency, as ordinarily employed, and in many of the most essential features the effects produced are the same. But they differ widely from the faradic current derived from the secondary coil of short, coarse wire. This latter is a current of much lower e.m.f. and very considerable volume or amperage, by comparison with the high-tension currents mentioned above. Its action is entirely different in consequence, and it cannot be supplanted by them.

In considering the physiological effect of periodic induced currents, several things must be taken into consideration.

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* Read before the Section on Gynecology and Obstetrics at the New York Academy of Medicine, March 28.

I.—As to Whether the Current Employed is an Interrupted Current of One Direction or a Truly Alternating Current.

If we recognize in the interrupted induced or faradic current a current of one direction endowed with polarity, which we must do if only the break current has sufficient e.m.f. to be appreciable through the resistance of the human tissues, it must be admitted that this current is capable of exerting some electrolytic action, though it may be slight. It is a demonstrable fact that the faradic current does produce electrolytic action, and that it is a current of one direction, when employed through the resistances of the human tissues. For this reason I have designated it an interrupted, induced current. It is true that through low resistances, such as a galvanometer placed in the circuit, it appears to be an alternating current, since upon making and breaking contact of the vibrator slowly the needle will be deflected to an equal degree on either side. But the make and break currents are of such unequal force (the break current being estimated to be thirteen times stronger in e.m.f. than the make current) that when applied through resistances like the structures of the body the break current only has sufficient force to penetrate and produce an impression, and it is only this phase of the current which we need take cognizance of. As a proof of this, take a sponge electrode in each hand, turn on the current, and make and break contact at the vibrator slowly. It is seen that a contraction is produced only when the contact is broken at the vibrator, and the subject experiences no sensation when contact is made.

To prove that this current does exert an electrolytic action, take a solution of starch, to which is added some iodide of potassium, and insert electrodes terminating in fine platinum wire. After the current has been turned on for a few moments a discoloration will be observed at one pole, due to the formation of iodide of starch.

Since the amperage of these induction currents as employed in medicine is insignificant by comparison with even the weakest constant current used, the electrolytic action may, in the main, be disregarded; yet we must recognize the effect upon nerve tissue, since an inverse current (or one in opposite direction to the nerve current) diminishes the functional activity of the nerve, and a direct current (or one in the same direction as the nerve current) increases its functional activity. In this respect the interrupted induced current possesses an advantage over the alternating, which is constantly reversed and has no polarity, an advantage by no means to be ignored in certain conditions.

II.—The Comparative Relation of the Two Qualities of the Current; E.M.F. and Volume, or Amperage.

This is important because the stimulating property of these currents is in proportion to the volume, which, in the case of the faradic current, may be varied by changing the length and size of the wire of the secondary coil. When the coil is composed of a very considerable length of fine wire there are necessarily a greater number of turns within the magnetic field of the core, which produces a current of high e.m.f., since the e.m.f.

depends upon the number of lines of magnetic force intersected. But because of the great length of fine wire, the resistance in the coil (i.e., the internal resistance) is greatly increased, hence the amperage of the resulting current is greatly reduced. When, on the other hand, the coil is composed of a short length of coarse wire, fewer lines of magnetic force are intersected, because there are fewer turns, and the resistance in the wire (internal resistance of the coil) is greatly diminished; hence such a coil will give a current of low e.m.f. and greater volume, or amperage.

In dealing with variable resistances like the human structures, a consideration of this point is particularly important, since much depends upon the selection of a current with a suitable e.m.f. to overcome the resistance encountered and produce the desired result. Likewise, since the stimulating property of the current depends upon its amperage, we must have an apparatus so arranged that the amperage may be varied as required. The cheaper forms of faradic apparatus are absolutely worthless, for gynecological use at least, because they are not constructed so as to make these variations possible. As a matter of fact the coil is usually composed of one length of rather coarse wire.

The modern induction apparatus, a type of which I show you, is so constructed as to give ten different currents from as many different lengths and three sizes of wire, and affords great variation in the qualities of the current. (See cut.)

This susceptibility to variations of the qualities of the current is another advantage

which the faradic possesses over the alternating and static induced currents derived from machines as now constructed and operated.

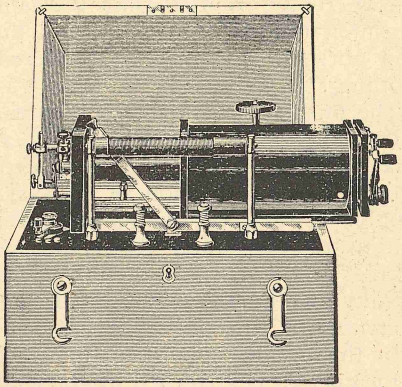
III.—The Frequency of the Periods or Interruptions.

This is important because the frequency of the interruptions has an important bearing upon the e.m.f. of the current generated, as well as upon the physiological effect produced. The e.m.f. of the current is, as a rule, increased by increasing the rapidity of the interruptions or periods, and high-tension currents are thereby rendered more soothing.

The most noticeable effect of periodic induced currents is a muscle, nerve, and circulatory stimulation, the latter depending mainly upon the action of the vasomotor supply. The degree and nature of this stimulation depend upon the e.m.f. and amperage of the current employed, and the rapidity of the impulses imparted by the interruptions.

In the faradic apparatus the stimulation of the current is governed by the length and size of the wire composing the secondary coil, which regulates the e.m.f. and amperage of the secondary current, the force of the primary circuit being constant or nearly so. The rapidity of the interruptions is controlled by the automatic vibrator in the primary circuit. The advantage, then, of a number of secondary coils, having different lengths of the same wire and different sizes of wire, is that the stimulating property of the current may be conveniently and gradually increased, as desired.

In the alternating machine now on the market the windings are all the same, hence the stimulating property of the current, which is a secondary, depends upon the strength of the current supplied to the primary fields. The e.m.f. and rapidity of the alternations, as well, are increased by increasing the speed of the machine; that is, by increasing the revolutions of the armature or revolving disc. The volume of the current cannot be greatly varied.



Dr. Goelet's latest Induction Apparatus, made by The Kidder Mfg. Co.

In the case of the static induced current, the stimulating property of the current depends upon the size of the Leyden jars and the distance between the discharging rods; that is, the size of the jars regulates the volume of the discharge, and the air-gap between the discharging rods regulates the rapidity of the impulses.

The marked difference in the effect produced by currents derived from the long, fine wire and the short, coarse wire secondary is just what would be anticipated from their different nature and properties, the former being a current of low e.m.f. and greater volume, and the latter possessing a high e.m.f., but an almost inappreciable volume. As shown by Duchenne, the current from the short, coarse wire acts more directly upon the muscles, increasing their contractibility, and is more localized; and the current from the long, fine wire acts more especially upon the sensory nerves and penetrates more deeply. I think we may go further, and say that the fine-wire current diminishes muscular contractibility; for, though the first effect may be that of a stimulant, it is secondarily sedative. The immediate effect of both forms of this current is, therefore, a stimulation; but the one, the current of volume, produces muscle stimulation, and the other, the current of tension or high e.m.f., produces a nerve stimulation; and in employing periodic induced currents these facts must be borne in mind.

One of the most important effects produced by these currents is stimulation of increased tissue changes (i.e., increased absorption of oxygen and corresponding increased elimination of carbonic acid by the tissues), and coincidently increased nutrition. Hence, they increase the functional activity of organs brought under their influence. This effect of the current can be readily demonstrated. For instance, its power to increase perspiration may be shown by grasping in one hand the bipolar electrode and using the fine-wire current as strong as it can be borne for a few moments. The hand becomes bathed in perspiration. Another effect observed is that the hand, but more particularly the fingers, soon become pale and bloodless, owing to the violent tetanic contraction of the muscles and the effect of the current upon the vasomotor supply. Improvement in the general nutrition of the patient has often been noted, even when only local applications have been made to the female pelvis, the improvement in the general health being out of proportion to that of the local condition.

The effect of these currents upon the capillary and lymphatic circulation is marked and most important. It is no doubt that their power to promote rapid absorption of inflammatory exudates may be attributed directly to stimulation of the capillary and lymphatic circulation.

I will venture to offer an explanation of how this result is brought about.

Faradic stimulation quickens the capillary circulation:

1. By exciting an increased vermicular contraction of the smaller arteries, the blood pressure is augmented. This causes momentary distention of the capillary vessels, the reaction from which, owing to their elasticity, empties or unloads them into the veins. In case of any obstruction in the capillary vessels this distention, together with the increased blood pressure, favors its removal.

2. By stimulating contractions of adjacent muscles, the veins are emptied, and a void is created in their intervalvular spaces, which invites the blood from the overloaded capillaries.

Increased activity of the lymphatics is brought about by faradic stimulation:

1. By stimulating the process of absorption, and—

2. By stimulating contraction of adjacent muscular structures, the circulation in the lymphatic vessels is increased. These vessels being supplied with valves similar to those found in veins, the contraction of surrounding muscles empties the intervalvular spaces and invites the flow of lymph from the lymph spaces where absorption takes place.

As the result of this action upon the capillary circulation and lymphatics, pelvic congestion is relieved and rapid absorption of infiltrations and exundations is accomplished. This agent is unquestionably the most powerful, the most certain, and therefore the most valuable vasomotor constrictor which we possess.

Perhaps the most important effect of periodic induced currents of high e.m.f. and great frequency is the production of sedation and the relief of pain. As pointed out by Duchenne, the special action of these currents is upon the sensory nerves, and it partakes of the nature of an excitation; but this excitation or stimulation will result in sedation if certain conditions are observed. This appears to involve an inconsistency; but you will recall the fact that opium is a cerebral and circulatory stimulant, yet its effect is sedative.

It is very necessary to understand that two results may be obtained from the application of fine-wire currents in particular, viz., stimulation and sedation.

Stimulation may be of two kinds: 1. Exciting, when it is irritating; 2, sedative, when it is non-irritating or soothing.

Very much, therefore, depends upon the method of application in bringing about the result desired. If the current is applied so as to maintain a constant state of excitation throughout the application, causing the patient to experience a moderate degree of irritation during the entire period of its administration by constantly and rapidly increasing the strength of the current, the result will fall short of sedation, and the parts will be left in a state of stimulation. The application need not be painful to produce this result. If, on the other hand, the current is applied so that it is barely perceptible throughout the application, its strength being gradually increased as insensitiveness becomes apparent, and the application is continued until complete relaxation and insensitiveness are produced, the result will be a sedation.

The former method of application is adapted to moderately insensitive conditions for promoting absorption of exudates and relieving the engorgement of the pelvic vessels when no inflammation exists and pain is not a prominent symptom. The latter method of application is appropriate for the relief of pain, acute congestion (even inflammations) of the pelvic organs, and to promote the absorption of recent exudations, and, in fact, should be employed in all acutely sensitive conditions.

The duration of the application likewise influences the result. A five or ten minute application may suffice for producing the form of stimulation described above, but sedation, which will be prolonged and satisfactory, is seldom attained with an application of less than fifteen or twenty minutes' duration.

The relief of pain which follows the application of these currents in the manner described for producing sedation may be explained in this way, viz.: the rapid succession of impulses imparted by the interruptions may be regarded in the nature of a percussion, which induces a condition of concussion of the nerve filaments, impairing their function to conduct painful impressions. The intense stimulation of the motor nerves produces a tetanic contraction of the muscles, which eventually wears out their contractibility, producing relaxation or a temporary local paralysis that means rest for the diseased parts which they encompass. It is probable, also, that relief of the congestion upon which the pain may in great measure depend is another way in which this result is reached.

The rapidity of the interruptions has likewise an important bearing upon the result, since the more rapid they are the more soothing the effect. Therefore, for a sedative effect, they should be as rapid as possible. In using the coarse-wire current for muscle stimulation, however, the interruptions should be slow, so as to allow an alternate contraction and relaxation, similar to the normal physiological action of the muscle.

The frequency of the applications and the subsequent behavior of the patient are also to be considered. Three times a week may be sufficient when a stimulation is required, and the patient may not be restricted in her movements especially to attain this result. But sedative applications should be made every day, in some instances several times a day; and, to be productive of the best result, they should be made after the patient has retired for the night, or she should be made to recline for at least an hour or two afterward. This is not always essential, however, for in very many instances the relief obtained continues for hours, even when the application is made in the physician's office and the patient is permitted to exercise moderately afterward.

As a therapeutic measure for the relief of pelvic pain and congestion, and pelvic inflammations and their results, infiltrations and exudations, this form of electricity is incomparable with any other agent which we possess. It is to be regarded not only as a remedy against the symptoms accompanying diseases of the female pelvic organs, but often as a curative agent as well, though frequently it serves only as an auxiliary to the other measures. In cases where the disease is so far advanced that a cure cannot be effected and some radical operation is necessary it serves an exceedingly useful purpose in placing the patient in the best possible position to withstand it, and aids its success by improving greatly the local condition and her general nutrition.

The coarse-wire current is particularly serviceable where there is loss of muscular

tone and venous engorgement, such as in subinvolution; but it is absolutely contra-indicated in sensitive and inflamed conditions.

I have purposely laid more stress upon periodic currents of high frequency and high e.m.f. because they cover a larger field of usefulness.

Hot water, which, under the advocacy of Dr. Emett, has for so many years been our mainstay, sinks into insignificance as a remedy in pelvic diseases, when compared with this agent, if it is properly used. But this is the point upon which the result hinges. It is so often misapplied.

Those of you who appreciate the importance of properly administering the hot water vaginal douche for its effect upon the circulation of the pelvis, know that unless it is done properly it is productive of more harm than good. You also know with what difficulties Dr. Emett has had to contend in introducing it as a remedy and getting the profession to appreciate the necessity of applying it in the right way. Then perhaps you can understand my position in regard to the interrupted induced or faradic current in gynecology. After an experience extending over a period of more than six years with this agent, I am more than ever convinced that it has no equal in the class of disorders in which I have stated it to be effective, and I feel certain that if you will use it intelligently, bearing in mind the points connected with its administration which I have tried to emphasize in this paper, you will come to the same conclusion.

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SENILE ENDOMETRITIS AND VAGINITIS*

BY

AUGUSTIN H. GOELET, M. D.

PROFESSOR OF GYNECOLOGY IN THE NEW YORK SCHOOL OF CLINICAL MEDICINE, ETC.

"THE ORMONDE,"
B'WAY, COR. 70TH ST., N. Y.

*READ BEFORE THE NEW YORK MEDICO-SURGICAL SOCIETY,
OCTOBER 5TH, 1896.

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The assumption that women are necessarily exempt from uterine disease after they have passed the menopause is an error. It is a mistake also to think that they are peculiarly exempt from inflammation of the genital tract, though it may be true that they are not so liable to acute inflammatory conditions as younger women, or rather when inflammation occurs at this age it is not apt to be so active. This belief concerning women past the climacteric is prevalent with the laity and is strengthened by the attitude of the profession at large, who are prone to regard the question with indifference. This may be due to the belief that there is little to be done for chronic inflammation of the uterus if it exists at this time and that it is incurable, hence it had better be left undisturbed. This is an error which is the result of past ineffective methods in dealing with inflammation of the uterine mucosa in general and of the attempt perhaps to apply here the same method of treatment that is effective in other forms of endometritis depending upon quite a different cause, and presenting quite a different pathological condition.

If the general practitioner will come to realize that women past the menopause may be liable to a chronic inflammation** of the uterine mucosa and that it is amenable to treatment, he will begin to look for signs and symptoms denoting it and he will find that it is by no means infrequent. He must be prepared for opposition on the part of the patient, who at this age is always reluctant to admit the possibility of such a condition and who would endure anything rather than submit to treatment. He will find it difficult to convince her that, having enjoyed, as she believes, an immunity from womb trouble previously, she can possibly have any such disease after the menopause. Yet, strange as it may appear, senile endometritis is more frequently found in women

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** Skene is inclined to regard this condition as a significant degeneration in the majority of cases, rather than as a chronic inflammation, with which view the author concurs

who have not received treatment for uterine disease earlier in life. This may be explained on the assumption that catarrhal inflammations, if they existed previously, were neglected because of the reluctance of most women to submit to treatment unless forced to do so on account of the severity of the symptoms. Still this does not by any means account for all of the cases of senile endometritis, for it has been discovered not infrequently in women who, from the closest scrutiny of their histories gave no evidence of any uterine disease whatever during their menstrual life, and I have seen it in women who had never married and never had children, and who had remained virgins. Hence I believe that, while senile endometritis may result from neglected endometritis occurring during menstrual life, the change in the uterus incident to the monopause is directly responsible for a great number of cases.

There can be no doubt that an impaired condition of the general system may be a strong factor in the production of senile endometritis which should not be overlooked. Yet by far its most active cause is the atrophic changes which the uterus undergoes at this time of life, depending upon a diminished activity of the pelvic circulation resulting in impaired nutrition of the organ. Not only does this alter the character of the glandular structure and of the secretions, but the epithelium of the mucous membrane undergoes a radical change and in some instances disappears completely. A general shrinkage and contraction occur and the canal of the cervix becomes narrower in calibre and eventually becomes obstructed, sometimes even almost obliterated. This condition is hastened by destruction of the mucous membrane in places, due to the acrid character of the discharge, resulting in the formation of bands of cicatricial tissue. These changes are not limited to the mucous membrane of the canal of the cervix, but involve the whole endometrium and are also to be observed in the vagina, where not infrequently, if the disease has been neglected, the vaginal vault is so narrowed from contraction of cicatricial bands that it is difficult to reach the cervix in some cases. I have been able to show at my clinic repeatedly cases of this kind and also to demonstrate the cicatricial contraction of the cervical canal.

The appearance of the mucous membrane of the vagina is characteristic in these cases. The rugæ

are effaced, and the surface is pale and glistening in places, a more nearly normal membrane intervening, upon which may be observed minute ecchymosed spots or apparently elevated intensely reddened papillæ, which consist of exposed capillary vessels, the epithelium being destroyed, they show through the delicate structure covering them. In some cases the whole surface of the vagina is intensely injected and inflamed, and is covered with an acrid muco-purulent discharge, derived in great part from the uterus. An active vulvitis is sometimes produced by contact of this discharge.

The uterus is the seat of change beyond that of the mucosa. Its walls are in some cases atrophied and the organ is much reduced in size. In other cases the walls are softened and the organ is enlarged and relaxed, which may be due to constant distention from the secretion retained within the cavity.

The character of the discharge is muco-purulent or sero-purulent, depending upon the duration of the disease and the extent of the changes that have occurred. It is usually more profuse and acrid as the disease advances and if it has been neglected. It is profuse at times, then again almost absent, because it is often retained from obstruction of the canal until over-distention causes its expulsion. The discharge is sometimes, though rarely, mixed with blood.

The symptoms which this condition gives rise to are by no means constant or invariable. Sometimes the patient will complain of a burning on the top of the head or a burning pain in the lumbar region or over the sacrum, but seldom is pelvic pain a prominent symptom. Pain is more often complained of when a posterior displacement of the uterus complicates the case. I have known these patients to suffer positive discomfort while riding in a carriage even over a smooth road.

Rectal tenesmus, due to a chronic proctitis, is sometimes complained of. Vesical tenesmus is more frequent, and in some instances there is a chronic cystitis with urethritis and a discharge from the urethra, muco-purulent in character.

The digestion is often impaired and with it there is marked evidence of malnutrition, giving a worn expression and the appearance of premature old age (Skene). This is perhaps due as much to chronic sepsis as to reflex disturbances caused by the local irritation. The appearance is so characteristic that

patients suffering with senile endomitritis may often be told by their general appearance, the facial expression, and the peculiar bronzed appearance of the skin. The general circulation is poor and these patients suffer with cold extremities, a dry, irritable condition of the skin, great nervousness, and not infrequently insomnia.

If a patient past the menopause complains of disordered digestion, is thin and poorly nourished, the skin is dry and irritable, and the general circulation is poor, a diagnosis of senile endometritis is safe, even if she denies the existence of any discharge or pelvic symptoms, and I always insist upon an examination, especially if her symptoms have resisted treatment for their relief.

TREATMENT.—To apply here the same method of treatment that is employed for endometritis in younger women will meet with signal failure. The attempt to dilate the obstructed canal with the steel dilator or graduated bougies in the usual manner will in many cases result in rupture. When the disease has progressed to the stage in which cicatricial bands have formed, rupture is certain to occur if forcible dilatation is attempted. These bands will not yield, consequently the intervening soft, friable tissue gives way. The use of the curette in most cases is unwise and unnecessary. The mucous membrane has already been destroyed and nothing remains to be removed. Likewise the application of caustics and irritants to the endometrium is most injudicious. Enough injury has already been done by the acrid secretion and only harm can result from such harsh measures.

Dilatation of the canal to promote free drainage of retained secretions is most important, in fact absolutely imperative, for persistent drainage with absolute asepsis of the endometrium is the only manner of effecting a cure. How drainage is best accomplished, and how maintained, is the main question at issue.

In the early stage, when only a year or two have elapsed since the menopause, and particularly if there is retroflexion of the uterus, dilatation to rectify the malposition and careful curettage, followed by appropriate after-treatment, are unquestionably the wisest measures to adopt, but later these are not only useless but unwise. At this stage dilatation, if carefully done, will produce no injury, and the curette may be used to advantage, but after-treatment to maintain a patulous condition

of the canal and an aseptic condition of the cavity by repeated irrigation must be persistently carried out.

In the beginning the patient's confidence must be gained, and she must be made to appreciate the fact that her disease is essentially chronic and dependent upon the natural changes that the uterus must undergo ot this period; that these changes are progressive and continuous up to a certain point, and that consequently a cure cannot be accomplished quickly. She must therefore be made to realize the importance of keeping herself under observation and under treatment at gradually increasing intervals until these changes are completed. This done, we are prepared to undertake the treatment of the case, and can promise not only speedy relief of her symptoms but a positive cure, if it has not been too long neglected and malignant degeneration has not occurred.

In those cases in which the disease has progressed and forcible dilatation is not permissible, some other means must be adopted for freeing the canal and maintaining drainage. For a number of years I have employed with entire satisfaction in these cases the negative pole of the galvanic current through conical electrodes of gradually increasing size. This will inflict no injury if care is taken to avoid cauterization or destruction of tissue by using a moderate strength of current. When the necessary degree of dilatation is accomplished in this manner, a small clinical double-current irrigator is inserted, and the cavity is thoroughly irrigated with a weak solution of lysol (one-half to one per cent.). The irrigator has an attachment which permits it to be utilized as an electrode, and it is connected with the negative pole of the battery and the current (ten to fifteen milliamperes) turned on while the irrigation is going on, from a half to one pint of the solution being used each time. Thus, through the medium of the water, the stimulating effect of the agent is obtained upon the whole endometrium, and the cavity can be most effectually cleansed. The reaction of the current seems to enhance the value of the lysol solution in removing the sometimes tenacious secretion which adheres to the surface of the endometrium and is not otherwise easily removed. It seems likewise to neutralize the virulence of the discharge, which has an acid reaction.

After one or two applications the canal will usually remain sufficiently patulous to permit the introduction of the small irrigator without using the dilating electrodes previously, if too long an interval has not intervened. The irrigation should be repeated every two or three days during the first week or two, and as the condition improves the interval should be lengthened. Thus, during the second month once a week will suffice in some cases, and during the third month once in two weeks. Then the patient should be required to return for treatment once a month for a few months. Some cases will improve more rapidly and others will require even a longer time before a positive cure is effected.

The surface of the vagina must be cleansed also, either by means of the irrigator with the lysol solution or it is wiped out with a pledget of absorbent cotton wet with the same solution and held in the grasp of a dressing-forceps. The vaginal surface and vulva as well are then dusted freely with some bland non-irritating antiseptic powder. For this purpose I have employed with much satisfaction markasol, a new preparation, said to be borophenate of bismuth, which answers the purpose admirably in counteracting the virulence of the discharge and soothing the inflamed membrane.

The patient is directed also to use the same powder in a vaginal douche once or twice a day, dissolving a teaspoonful in a quart of warm water. If the vulva is inflamed or excoriated, the surface after it has been thoroughly washed with the solution and dried is kept dusted freely with this powder. The labia are kept separated with a layer of absorbent cotton, which is removed when it becomes moist.

If the uterus is retroflexed it must be rectified, and, when possible, a vaginal pessary inserted. In those cases particularly not long past the menopause, the displacement can best be overcome by first carefully dilating and straightening the canal in the manner I have described elsewhere for overcoming retrodeviations. In some cases, however, the shrinkage and contraction of the vaginal wall will make impossible the employment of a pessary to any advantage. In these cases ventral suspension of the uterus may be resorted to. I cannot think that a hysterectomy would be justifiable for this condition, since I have never yet met a

case that did not yield to the plan of treatment here outlined.

When the bladder is involved, it must receive attention also. It should be washed out twice or three times a week in the beginning with a saturated solution of boric acid, or, what I very much prefer, markasol, half a teaspoonful to a quart of warm water, because it is more soothing and the relief which it affords is more permanent. For this purpose the double-current irrigator or a glass catheter may be employed. It will usually be found that the urethral mucous membrane has undergone a decided change and has lost its epithelium in places, as shown by the intensely injected folds which project at the meatus, resembling very much urethral caruncle. At the entrance to the bladder the membrane is hypertrophied and very hyperæsthetic, and complete evacuation is prevented. This retained urine becomes decomposed and provokes irritation. For this condition I have found that dilatation of the urethral canal with the conical dilating-electrodes connected with the negative pole yields the best result. Only a moderate strength of current (five milliamperes) should be used for two or three minutes each time the bladder is washed out. The vesof the discharge and soothing the inflamed membrane.

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In some instances the treatment of these cases of senile endometritis and its complications is tedious and taxes the patience of both physician and patient. But if in the beginning she is made to understand the situation clearly and can be made to appreciate the fact that improvement and relief of symptoms do not mean a cure, she can be controlled and kept under observation until a positive cure is effected, and she will be amply repaid by the relief it affords. I know of no gynecological disorder the treatment of which I undertake with more certainty of success.

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ELECTRICITY vs. THE CURETTE IN THE TREATMENT OF BLEEDING FIBROIDS OF THE UTERUS.

—BY—

AUGUSTIN H. GOELET, M.D.,

NEW YORK.

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ELECTRICITY *vs.* THE CURETTE IN THE TREATMENT OF BLEEDING FIBROIDS OF THE UTERUS.[1]

By AUGUSTIN H. GOELET, M.D.,
NEW YORK.

IT has come to the knowledge of the writer that patients to whom electrical treatment had been suggested for the relief of painful and bleeding fibroids, have sometimes been misled by certain opponents of this agent, and made to believe that the application of the curette to the endometrium would do as much for their condition as electricity, particular stress being laid upon the assertion that this operation possessed the additional merit of involving a very much shorter period of treatment. Were this true no one would be more willing to admit it than I, and, for obvious reasons, more willing to adopt it in preference to the other more protracted method of treatment.

It is time the general medical public should know just what is to be accomplished by either method properly carried out. That is, just how little may be expected from curettment, and the uncertainty of permanent benefit, on the one hand; and on the other hand, how much is to be gained by the use of electrcity, and the permanency of the result obtained.

Of curettement it may be said that it will sometimes temporarily arrest the bleeding, though this result is by no means constant, nor is it ever permanently effective, frequent repetition of the operation being necessitated by recurrence of the hemorrhage. It exerts no possible effect upon the growth of the tumor, either in reducing its size or arresting its development, consequently the pressure symptoms and harrassing pains are unrelieved by it. While, on the other hand, the irritation produced by the traumatism inflicted upon the endometrium may aggravate the peri-uterine engorgement, and cause increased development of the tumor by the formation of adhesions between contiguous peritoneal surfaces, with more permanent fixation of the mass, and increased blood supply. The patient may thus be rendered more uncomfortable, since the discomfort of a large fibroid is mainly due to its immobility, and the constant pressure upon the nerves of the pelvis and important pelvic organs. When comparative mobility can be preserved or secured, the suffering caused by these tumors is greatly lessened.

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[1] Read before the Gynæcological Section of the New York Academy of Medicine, May 26, 1892.

Let us consider the causes of the hemorrhage and see if this operation alone directed against one symptom can possibly be expected to exert any permanent benefit.

The hypertrophied and hyperæmic condition of the endometrium, which is held accountable for the hemorrhage, is brought about by certain influences exerted by the fibroid in the uterine wall and its pressure in the pelvis, chief of which is obstruction to the return circulation and consequent blood stasis. The hyperæmia is the result of an increased blood supply from hypertrophy of the arteries supplying the uterus, and also from new blood-vessels derived from attachments with adjacent surfaces by adhesions. When the tumor has attained such a size as to press upon the pelvic or abdominal viscera, or the walls of the pelvis, adhesions are formed between the contiguous peritoneal surfaces in consequence of a peri-uterine inflammation, the result of irritation induced by the fibroid, and additional nourishment and stimulus for its growth is then furnished by new blood-vessels entering through the adhesions.

The hyperæmia of the endometrium then is secondary to a condition beyond it—blood stasis involving the whole mass from obstruction to the return circulation and increased arterial blood supply. The irritation exerted by the presence of the tumor in the uterine wall is likewise an important factor in the causation of this condition. *It is a well-known fact that the endometrium is rapidly reproduced, and since its removal by the curette exerts no influence upon the condition which produces its hyperæmia, that is, does not cause a diminution in the size of the tumor or loosen its attachments, or relieve the blood stasis and increased blood supply, the same condition reverts in time and with it the hemorrhage.*

Against the operation it may be urged that a needless shock is inflicted upon a system already greatly exhausted by repeated hemorrhages, and deranged by the nervous strain and anxiety consequent upon the condition. This shock should not be ignored and cannot be denied, since it is considered necessary to anæsthetize the patient to enable her to bear the operation.

The increased vascular pressure caused by large fibroids, to which attention has been drawn by some writers, reacts upon the cardiac muscle and engenders a tendency to fatal collapse after operations in these cases, and is to be added as an additional argument against an operation which has so little to commend it.

Hofmeier, in 1884,[1] called attention to the frequency of cardiac disease in cases with large uterine fibromata as an explanation of the sudden death from shock sometimes observed after operations upon patients with these tumors. He referred more particularly to removal by hysterectomy, but he reports 5 deaths from this cause, occurring before any operation, and 5 following labor, out of a series of

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[1] *Medical and Surgical Gynæcology*, Pozzi, Vol. I, p. 234.

18 cases, showing that sudden death may occur at any time and upon the slightest provocation, and any procedure which submits an added element of danger in these cases should be carefully avoided when possible. Other writers have made similar observations. Fehling, in a series of 14 cases found 4 with marked signs of cardiac alteration. He also observed symptoms of heart disease in 3 cases with fibromata of middle size. Dower, in America, made similar observations, and Fenwick presented a paper on the subject to the Gynæcological Society of London (*British Gynæcological Journal*, Vol. II, p. 72). Of 18 cases of tumor of the abdomen collected by Sebileau, of France, for observation upon this point, 17 gave evidence of cardiac disease.

The danger of perforating the uterine wall with the curette is regarded too lightly, though it has occurred more frequently than perforation with the electrode, which is held up to view as one of the horrors incident to electrical treatment. This objection can hardly be advanced, however, against the treatment of fibroids for the control of hemorrhage by electricity, as large carbon electrodes are generally employed for this purpose.

Of the treatment by electricity, it may be said that it will positively control the bleeding, and the result will be permanent, if the details of its application are carefully observed. The pressure symptoms and harrassing pains are relieved, and there is almost always a very appreciable diminution in the size of the tumor, brought about by the application of the positive pole, for the control of the hemorrhage. The anti-hemorrhagic action of the positive pole is directly attributable to the cauterization of the endometrium, and the retractile nature of the resulting eschar, which places a barrier between the blood-vessels and the uterine cavity. But that the hæmostatic effect of the current is not entirely due to its local action, is

proven by the fact that puncture with the positive pole, when the tumor can be reached by the vagina, and even the ordinary vaginal application of this pole, are known to produce the same effect.

There is a most pronounced influence upon the uterine and peri-uterine circulation involved in the action of the current, which is manifested by a diminution of the general hyperæmia of the whole mass and lessening of the blood stasis. This is due, no doubt, in great measure to the cataphoric action of the current, which produces depletion in the vicinity of the positive pole, by driving the fluids toward the negative.[1]

One of the first effects observed from the action of the current is an increased mobility of the mass from loosening of its attachments, and this aids greatly in relieving the obstruction to the return circulation by removing the constant pressure upon the vessels surrounding the uterus. This obstruction to the venous circulation constitutes by no means an unimportant factor in the reproduction of the hemorrhagic tendency of these fibroid conditions, and affords an explanation of the temporary effect of curettement.

The advantages in favor of electricity, besides those already mentioned, are that its application involves no shock; no anæsthetic is required; confinement to bed is avoided; the patient can be treated at the office, thus deriving all the benefit to be obtained from an out-door life; and immediate improvement in the general health is coincident to the treatment. A very considerable reduction in the size of the tumor is frequently obtained, especially from vaginal puncture. A symptomatic cure can be confidently promised, and by this I mean absolute and permanent control of the hemorrhage, freedom from pain, and removal of the pressure symptoms. This statement does not apply, of course, to conditions where complications render the proper application of the agent impossible.

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[1] Buckmaster, in an essay published in the Brooklyn Medical Journal, November and December, 1888, illustrates the action of the current by some interesting experiments made upon fibroid tissue. The article is well written, and should be carefully read by those who believe that electricity is incapable of exerting any decided influence upon morbid conditions of the female generative apparatus.

A careful observance of minute details is essential for success with this treatment. It must be understood that, if the hemorrhage is not controlled promptly by applications with the usual platinum sound electrode, the cervix must be dilated and a carbon electrode which will fit the cavity and form contact with its walls must be substituted, and the whole surface of the endometrium, from fundus to os internum, must be submitted to the action of the current.

The carbon electrodes of Apostoli, intended for sectional cauterization, are the only ones suitable for this purpose. Doubtless, many of the failures to control uterine hemorrhage with this agent are the result of an imperfect understanding of the principles involved in its application; and I am quite sure that failure is frequently due to the use of electrodes which are not adapted to meet the requirements, and but an imperfect application has been made. Contact with the surface is necessary for effective cauterization, and each section included by the electrode must be submitted to the continuous action of the current for at least five minutes in obstinate cases. The strength of the current is a matter of importance, and must be adapted to suit each individual case. It must be understood that a greater strength of current can be employed with the carbon electrode, because it presents a greater area of surface contact than the sound electrode, and because the cervical canal, which is more sensitive than the cavity, is excluded.

351 West Fifty-seventh Street.

THE TREATMENT OF UTERINE FIBROIDS.

BY

AUGUSTIN H. GOELET, M. D.,
Gynecologist to the WEST-SIDE GERMAN CLINIC, New York.

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Editor American Medico-Surgical Bulletin.

THE TREATMENT OF UTERINE FIBROIDS.*

By AUGUSTIN H. GOELET, M.D.,

Gynecologist to the WEST-SIDE GERMAN CLINIC, New York.

THESE tumors are an out-growth from the muscular and connective tissue of the uterine wall, and according to their location in relation thereto, are divided into:

Submucous, when they are found projecting into the uterine cavity.

Interstitial, when they develop wholly witihn the wall of the uterus.

Subperitoneal, when they project from the outer wall of the uterus into the peritoneal cavity.

Another division which is clinically important, since it concerns both the growth of the tumor and the plan of treatment to be adopted, relates to the character of the tissue composing the tumor mass, viz: (*a*) soft or myomatous growths, when muscular tissue predominates, and (*b*) hard or fibromatous growths when they are composed of connective tissue, and are hard and fibrous in structure.

The pure myomata develop more rapidly than the fibromata or the fibro-myomata where the tissues are mixed. Fortunately the myomata and fibro-myomata yield more readily to treatment than those which are denser in structure.

Submucous fibroids tend to become pedunculated and detached from the uterine wall, and are then easily removed. Their presence in the uterine cavity excites contraction of the organ, which favors their pedunculation and ultimate expulsion. They seldom attain a very considerable size without giving rise to so much inconvenience, as to cause their detection.

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*Read before the N. Y. County Medical Association, Nov. 20, 1893.

Interstitial growths, which are more amenable to treatment, usually attain a greater size than the other varieties.

Sometimes the treatment instituted with a view of reducing the size of this class of tumors, and relieving the symptoms which they give rise to, will cause them to project into the uterine cavity; and, if the intervening tissues be broken down, the mass will become separated from its capsule, and it may be removed by the vagina through the os uteri.

Subperitoneal growths are most frequently small and seldom reach a very considerable size. They are less amenable to strictly non-surgical treatment than the former variety, unless situated favorably for a plan of procedure to be described further on. Exceptionally they do develop to a considerable size when, if they cause sufficient inconvenience to warrant the risk, their removal is demanded.

The important question which arises in dealing with these growths, is, when is interference demanded? and what treatment is indicated?

We may exclude from this general consideration tumors of the submucous variety, since their removal usually involves so little risk that no other procedure need be considered.

When applied to the other two varieties, these questions are not so readily answered.

A careful review of the literature of the subject and the opinions of those who are

entitled to be regarded as speaking authoritatively, leads to the conclusion that the majority do not regard the removal of these tumors indicated unless they produce symptoms or give rise to sufficient inconvenience to warrant the risk of the operation and the mutilation which it involves; and that the mortality attending their removal is still too great, even in the hands of expert operators, to warrant its being lightly undertaken. This being the case, if we have at hand a remedy, which will, in the large majority of these cases, remove the symptoms, the actual necessity for such operative interference is narrowed down to a very small field.

My experience with uterine fibroids, which has been somewhat extensive, leads to the conclusion that only a very small percentage are not amenable to treatment by the plan to which I refer.

I cannot agree with certain ultra-gynecologists that these tumors should be removed when they are small and cause no symptoms or inconvenience. Neither do I contend that electrical treatment is appropriate for all cases. Yet, I do contend that these tumors, when small, should best be submitted to this plan of treatment, even if they give rise to no inconvenience, for it is when they are small and of recent growth that the best results have been reached with that agent.

It would be obviously incorrect to treat all fibroids in the same manner, for they are not alike, either in structure or the amount of inconvenience they give rise to. Yet, this is not infrequently done. Failures must be anticipated until greater discrimination is observed. It would be equally erroneous to treat all fibroids exclusively by ergot or electricity as it would be to condemn all cases to removal by hysterectomy.

I have chosen to take up separately the indications for the different methods usually adopted at the present time, and will endeavor to answer the questions propounded above in the proper place in connection therewith. Since I hold the opinion that palliative measures should precede radical operative interference, unless some good reason exists for the latter, we will begin with :

I. When is electricity indicated ?

Interstitial growths, of whatever size, when they are discovered, whether they give rise to symptoms or not, should be submitted to this form of treatment. First, because if they produce no inconvenience, and are not apparently growing at the time they are observed, they may eventually do so ; second, because it is easier to cope with them when they are small, and because the best results have been obtained with this agent when the tumor is small and of recent growth.

As to what may be accomplished. Frequently, it is true, a symptomatic cure is all that may be obtained, through not infrequently a very considerable reduction in the size of the tumor may result; this depending upon the character of its structure, its location, and the method of treatment adopted.

There are two principal methods of applying this agent, viz: intra-uterine applications and vaginal puncture.

The purpose of the intra-uterine applications is :

1) Cure of any co-existing endometritis.

2) Loosening of adhesions between contiguous peritoneal surfaces.

3) Relief of pain and pressure symptoms.

4) Control of hemorrhage.

5) Arrest and retrogression of the growth.

This method of application will sometimes effect considerable diminution in the size of the growth, but I believe more success in this direction is obtained by puncture, which submits the structure directly to the polar action of the current. This opinion seems justified when we take into consideration the fact that removal of a wart or mole is accomplished only by puncture, and little or no effect will be produced by a simple application to its external surface.

Vaginal puncture is, I believe, a thoroughly safe procedure if it is properly done, and strict asepsis is observed,—in other words, if as much care is taken in this as in other grave surgical procedures. I will say here that I think more success would have followed the use of electricity in these conditions, if puncture had not been abandoned as a hazardous measure.

It is important to discriminate in the choice of the pole to be employed against the different structures encountered in these growths; just as important as upon the external surface of the body in dealing with warts, moles, and nævi. When the structure is hard and fibrous, the negative pole is to to be employed, and when it is soft or myomatous the positive is indicated.

In subperitoneal growths this agent cannot be used to much advantage unless they are situated favorably for vaginal puncture. Intra-uterine treatment in this class of tumors usually gives a negative result, so far as any reduction in the size of the tumor is concerned.

In very large, hard tumors, where much retrogression cannot be expected, if the general health has become deteriorated, electricity serves a useful purpose in building up the general health of the patient to a point where an operation for the removal of the tumor will be tolerated.

In submucous fibroids electricity is indicated before their removal only when they are not sufficiently separated from the uterine wall to admit of removal.

After the removal of pedunculated submucous fibroids, and a thorough curettage of the cavity, electricity will be useful for reducing the size of the enlarged organ, and for insuring complete control of the hemorrhage.

In spite of assertions to the contrary in some quarters, the proper use of electricity in these cases does not complicate a subsequent operation for the removal of the tumor, but, on the contrary, facilitates the removal of adhesions and produces a marked improvement in the general condition of the patient.

As to a return of the symptoms after discontinuing treatment, which has been asserted by MARTIN, of Berlin, and others, this has not been my experience.

If hemorrhage recurs after it has been once arrested by the treatment, I am satisfied that it is due to a faulty technique which may be unavoidable.

II. When is curettement indicated?

When hemorrhage is excessive, curettement is indicated as a preliminary measure to the treatment by electricity. In this manner the bleeding may be more promptly controlled, and if an anesthetic is employed a more thorough examination of the uterine cavity may be made, and the exact location of the tumor in relation thereto may be determined. The dilatation necessary to allow the proper use of the curette permits a more thorough application to all parts of the uterine cavity when electricity is subsequently needed.

Curettement is likewise indicated when bleeding persists under appropriate electrical treatment, and when a hemorrhage recurs after it has been controlled by the treatment. Such an occurrence would indicate that the applications had not been thorough; that either a cavity or pouch exists beyond the penetration of the electrode, or the cavity is irregular and tortuous, and all parts have not been reached. I am satisfied that this is the explanation in those cases where it has been asserted that the hemorrhage returned with increased severity after it has been controlled. Quite often the hemorrhage may be controlled by persistent vagino-abdominal applications without entering the uterine cavity, but I am inclined to regard the arrest only temporary. In order to permanently control the bleeding, I believe it is necessary to remove the diseased mucus, either by means of the curette or the chemical galvano-caustic applications; or to change its character completely by the application of cupric electrolysis. We have in cupric electrolysis a remedy which should never fail in these cases, if all parts of the cavities can be reached, for the reason that not only is an astringent salt—the oxychloride of copper—liberated in the cavity, but the cataphoric action of the current drives it into the tissues beneath the surface to a considerable distance.

Should hemorrhage persist in spite of these measures, we need not feel compelled to perform a hysterectomy merely to control it, as we may resort to ligation of the uterine arteries per vaginam, as suggested by Martin, of Chicago. This procedure, in addition to controlling the hemorrhage, should produce a very considerable shrinkage of the tumor, as these vessels furnish the uterus with its principal blood supply. We must not, however, lose sight of the fact that these tumors frequently derive an extraneous blood supply from adhesions with adjacent viscera. This is one reason why curettement alone will not always permanently control hemorrhage in these cases.

Ergot has lapsed into obscurity as an independent remedial measure in these cases. It unquestionably serves a useful purpose, however, as an auxiliary in certain submucous and soft interstitial myomata, when it is desirable to excite uterine contraction.

I have no confidence in either ergot or hydrastis for controlling hemorrhage due to the presence of fibroids.

III. When is hysterectomy indicated?

Hysterectomy is particularly indicated in the very large and hard interstitial, as well as subperitoneal, growths, which yield little, if at all, to any form of treatment. It is true that in very large interstitial growths the symptoms can be relieved and the general condition can be greatly improved; but the size of the tumor always makes it a source of serious inconvenience, and it should be removed if the condition of the patient warrants the risk. This, I think, is the principal

field for this operation. This does not apply to all large interstitial tumors, for in some cases a very decided reduction in their size results if the conditions are favorable for properly carrying out treatment. For this reason, I would urge that in all cases, unless there is some imperative reason for immediate surgical interference, and the case is one that will permit the proper application of electricity, that the radical operation be delayed.

If, in any of these cases, the treatment should fail to permanently control the symptoms, the advisability of hysterectomy is to be considered. For, if it is necessary to keep the patient continually under treatment in order to hold the symptoms in abeyance, she had better be submitted to the risk attending the radical operation. But if the pressure of the tumor causes only slight hemorrhage, which is readily controlled from time to time, and it is not large enough to give other inconvenience, and is not increasing in size, hysterectomy need not be considered necessary, especially if the patient is nearing, or has passed, the menopause.

When the situation of the tumor is unfavorable for the application of electricity, and it is giving inconvenience, hysterectomy is indicated under appropriate conditions.

I mean by this that sometimes an electrode cannot be introduced into the canal, and the tumor cannot be reached for vaginal puncture. But even in these cases, vagino-abdominal applications will sometimes accomplish a good deal.

If hemorrhage is not controlled by curettage and electricity, we may resort to ligation of the uterine arteries before considering the question of hysterectomy. Thus, I cannot see that hysterectomy would ever be necessary simply for the control of hemorrhage.

It has been my experience that hemorrhage is always controllable by curettage and electricity combined, and I have had some very desperate cases to contend with. I think, however, that there is a field for ligation of the uterine arteries.

When these tumors are complicated by purulent accumulations in the appendages, electricity is contra-indicated, and hysterectomy holds out the only chance for relief. This complication may be unsuspected until the attempt is made to employ galvanism, when the sharp reaction which follows warns the operator not to attempt a repetition. Thus it serves a useful purpose as a means of diagnosis in these cases.

IV. When is removal of the appendages indicated?

The removal of the appendages for the purpose of inducing an artificial menopause, in the belief that this will exert a favorable influence upon the tumor, has not been productive of satisfactory results, and has therefore been abandoned by most operators in favor of extirpation of the tumor and uterus, when operative interference is demanded.

It has been shown that removal of the appendages produces little, if any, effect upon the tumor, and hemorrhage is not immediately arrested, but, on the contrary, is sometimes more profuse afterward. In the most favorable cases several years sometimes elapse before even menstruation ceases entirely. I have had several cases sent to me for the purpose of arresting

severe hemorrhage after removal of the appendages.

The only instance in which I consider this operation justifiable would be as a compromise measure when, upon opening the abdomen, removal of the uterus and tumor is found to be impossible owing to extensive and inseparable attachments. Even then it is a doubtful procedure, since little can be positively gained by it, and I think it should be limited to those cases where the appendages are found to be diseased.

After the abdomen is opened and the appendages are removed, it usually involves very little additional risk to remove the tumor also. The object of an operation of this character and gravity, should be to rid the patient of the tumor, and for nothing short of this should the abdomen be opened in these cases.

I will admit that, under many circumstances, but not all, the woman would be better off without the tumor,—that it would be better for her to take the risk of the radical operation if no other chance of ultimate relief is open for her, but one must take into consideration the fact that these tumors seldom terminate fatally if left alone, if we except hemorrhagic cases, and the risk of the operation with the mutilation it involves must be weighed in the balance with the degree of inconvenience their presence causes.

I will not discuss the relative merits of total extirpation and supra-vaginal hysterectomy, as I fear I have already taxed your patience.

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ELECTRICITY IN GYNECOLOGY.

BY

AUGUSTIN H. GOELET, M.D.

"THE ORMONDE,"
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Editor American Medico-Surgical Bulletin.

ELECTRICITY IN GYNECOLOGY.*

By AUGUSTIN H. GOELET, M.D.

THAT electricity is a valuable therapeutic agent in female pelvic disorders will not be denied by any one who has had even a limited experience with it, but those who have employed it extensively, according to modern methods, have come to realize that it is absolutely indispensable, even more so than opium, for the relief of pain. Therefore, the physician who would keep abreast with the advance in practical therapeutics, and who has the interest of his patients at heart, cannot afford to leave it untried because some have seen fit to oppose it. That its use has extended, and its influence upon gynecological methods has continued to increase in the face of opposition from some of the most prominent members of the profession, are evidence of its merit, and should be sufficient to stimulate those who have not done so to test it for themselves and ascertain the truth.

The claim is not that electricity is a panacea for all the ills that women are heir to, but that it is possible to do more, and many times do it better, with this than with any other agent at our command. True, in some instances, it is to be regarded only as an auxiliary to other measures, often operative, but in others successful results may be reached with it practically unaided. One very decided advantage in its favor is that the general practitioner, by familiarizing himself with its application, can cure many of his gynecological cases himself, instead of sending them to the specialist.

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* Being a contribution to the discussion "Electricity in Medicine, from a Modern Standpoint" at the Meeting of the New York State Medical Society held at Albany, Feb. 5, 6, and 7, 1895.

Let us review briefly what may be accomplished by electricity in gynecological conditions and study the rationale of its action.

The electrolytic action of the galvanic or constant current, the exact nature of which is now pretty clearly understood, serves many useful purposes, and is susceptible of variation, according to the pole employed and the method of application. We now know that there is not only a negative and a positive electrolysis, which are widely different, both in chemical results and therapeutic action, but that there is an interpolar electrolysis, which exerts a very decided influence upon physiological action.

Negative electrolysis by liberating the bases and hydrogen produces softening and relaxation and stimulates absorption of effete products. When applied directly to a mucous surface, such as the uterine canal, an active cauterization can be produced if the current is made sufficiently strong.

Positive electrolysis, which results in the liberation of the acids, chlorine, and oxygen from the tissues, produces a drying effect, in which it is aided by the cataphoric action of the current (or that power possessed by the current of influencing fluids to move in the direction of the current from the positive

to the negative pole). Likewise the liberated chlorine and oxygen exert a germicidal action and the acids produce a peculiar acid cauterization. The action of positive electrolysis, then, upon a mucous surface may be regarded as an astringent or drying acid caustic, the intensity of the action depending upon the strength of the current. The cataphoric action serves a very useful purpose in promoting the absorption of fluid effusions, infiltrations, and extravasations.

So far as it has been possible to observe, interpolar electrolysis results in: 1. A forced elimination of the watery or fluid portion of the tissues through which the current is made to pass and, consequently, a shrinkage and loss of weight; 2, when a strong current, greatly concentrated, is employed, the characteristic of muscular structure is materially altered; that is, it becomes structureless or granular.

When a metal other than platinum or gold (which, owing to their not being oxidizable, are the only metals which can be employed for producing positive electrolysis) is used as an electrode for the positive pole, it is attacked by the oxygen, chlorine, and acids, instead of the tissues, and, in consequence, we have a metallic electrolysis, which results in the formation of an oxychloride of the metal employed. This salt is deposited upon the surface to which the electrode is applied, and the cataphoric action of the current causes it to be transmitted to a considerable distance beneath. This process has been utilized to advantage not only in intensifying the germicidal action of the positive pole, but as a means of applying the salt of the metal employed to any surface where its action is desired. Thus, by employing copper in this manner, a strong antiseptic astringent salt, the oxychloride of copper, is obtained. The oxychloride of zinc obtained in this manner produces a moderate astringent cauterization, but which is nothing like so destructive in its action as the ordinary chloride of zinc. The intensity of the action can, of course, be varied by varying the strength of the current. Silver and tin have also been employed, and have been found to serve a useful purpose, because the salts of these metals thus formed are moderate, non-irritating astringents.

This method of topical medication may be regarded as one of the greatest advances in modern therapeutics.

We come now to the consideration of a form of electricity which has not been fully appreciated by the greater part of the profession, chiefly because until very recently satisfactory apparatus could not be obtained, and because literature bearing upon its application is meager. I refer to periodical induced currents, which include the faradic, alternating, and static induced.

Of these three forms of induced currents the faradic is the most generally useful, because it is applicable to a greater number of conditions and the apparatus for its production is more readily obtainable. More stress will therefore be laid upon this in the present paper.

The principal advantages in the use of electricity in this form are its property of allaying pain, relieving congestion and engorgement, increasing nutrition, and promoting absorption of exudates, infiltrations, and extravasations in the pelvis. It is to be regarded as a form of painless stimulation incomparable with any other therapeutic measure we possess. It will accomplish all that hot water will do, and much more, in a more satisfactory manner. It will relieve the pain of inflammatory conditions more promptly and more permanently than opium without disagreeable after-effects. For promoting absorption of infiltrations and exudates it is superior to the galvanic current.

It will be interesting to study the action of periodical currents, and see how these results are brought about.

Pain is relieved and sedation is established by intense stimulation of the sensory and motor nerves, resulting in temporary suspension of their function. The rapid succession of impulses seems to induce a condition of concussion of the nerve filaments, and the tetanic rigidity of the muscles, by wearing out their contractibility, produces relaxation, and the parts are put at rest by obviating the painful contraction of surrounding muscles.

Congestion is relieved and absorption hastened by stimulating the capillary circulation and lymphatics to increased activity, which is brought about by the effect of the current upon the vaso motor supply. These results are, of course, to be obtained only by the high-tension faradic, alternating, or static induced currents.

The coarse-wire faradic current acts more directly as a muscle stimulator, is more local in its action, and is useful in restoring tone to impaired muscle tissue.

It may be readily surmised that an agent possessing the properties enumerated here will prove very useful in combating pelvic disease, and if it is not always possible for it to effect a cure alone, it must prove a valuable auxiliary which we cannot afford to ignore.

It would consume more time than is allowed in this discussion to enumerate the different conditions where this agent may be employed to advantage. What has already been said should be sufficient to show the rationale of its action. There is one point, however, which is important, but which has not been mentioned, viz.: That the peculiar action of the negative pole may be utilized for overcoming obstruction in the cervical canal, thus establishing drainage from the uterine cavity, which is so essential in the treatment of endometritis and salpingitis. In some instances these cases can be treated quite as satisfactorily in this manner as by curettage and gauze packing, and the use of an anesthetic and subsequent confinement to bed can thus be avoided.

The fine-wire faradic current also serves a very useful purpose in these cases, especially in salpingitis. Here it acts by removing the congestion and infiltration in and around the tubes, thus overcoming the obstruction in their caliber due to tumefaction; and by stimulating contraction of their walls, causing them to empty and drain into the uterus. In this manner many of these cases can be cured.

Mild cases of endometritis, such as the catarrhal variety, may be cured by this method of treatment, viz.:

Moderate (10 M) negative galvanic applications to the whole length of the canal, followed by faradization to overcome the associated hyperemia. In cases of a more aggravated type, metallic electrolysis may be employed with advantage, and will yield good results. It is quite important, however, in making such applications to the endometrium to preserve a patulous condition of the cervical canal for drainage, and, in some instances, it will be necessary to free the surface of the endometrium of retained secretions by irrigation of the cavity previous to making the application. This latter precaution is particularly essential in employing the current in this manner for the control of hemorrhage, since the accumulated blood and clots prevent the necessary action upon the mucous membrane.

The fine-wire faradic current is likewise particularly effective in relieving the pain and congestion of chronic ovaritis and salpingitis and promoting the absorption of surrounding exudates.

But to say more in this connection would be a repetition and unprofitable unless the time were sufficient to take up the different conditions separately and detail the method to be adopted in applying the current in each.

The essential elements for success in employing this agent in gynecology are:

1. Some knowledge of electro-physics and electro-physiology.

2. A fair ability to diagnose correctly, and

3. Proper apparatus.

The general practitioner must disabuse his mind of the idea that the old and cheaper forms of apparatus (faradic in particular) will answer his purpose because he does not expect to go into the subject as a specialist would do. Good work cannot be done with imperfect tools or slipshod methods.

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—THE—

INTRODUCTION OF DRUGS
INTO THE
HUMAN BODY
—BY—
ELECTRICITY.

Read before the Philadelphia Electro-therapeutic Society, Thursday evening, February 12, 1891.

—BY—

FREDERICK PETERSON, M.D.,
Chief of Clinic, Nervous Department, Vanderbilt Clinic, College of Physicians and Surgeons, New York.

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THE INTRODUCTION OF DRUGS INTO THE HUMAN BODY BY ELECTRICITY.[1]

By FREDERICK PETERSON, M.D.,

Chief of Clinic, Nervous Department, Vanderbilt Clinic, College of Physicians and Surgeons, New York.

It is with some degree of diffidence that I have ventured to accept the kind invitation of the former president of your society to read a short paper upon the subject of Electric Cataphoresis, for the reason that I have already written about all that I know concerning it, and that I already find myself placed, with many of my good friends, among hobby-riders. Just as some of them are designated, or at least in danger of being so-called, Apostoli cranks, bacillus cranks, hydrotherapeutic cranks, and the like, so I have begun to hear faint whisperings of a similar term applied to myself in connection with anodal diffusion. But I wish to shun the imputation at once, by stating that it is not a panacea for all human ills, that, indeed, it is useful in only a few conditions of the human system. Presuming, then, that its limitations as a therapeutic agent are many, it is in order to speak of it first historically and then practically.

While the diffusion of solutions through a membrane by the anode, and of the sarcous substance of muscle from the anode to the cathode had been known to electricians, the earliest investigation of its power to drive drugs through the human skin was made by Richardson in 1859 with morphine, aconite and chloroform. Nothing further was written until 1886, when Wagner, Adamkiewicz, Lumbroso, Matteini, and others re-introduced the subject in connection with chloroform. Corning and Reynolds made some experiments later with cocaine solutions upon the anode.

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[1] Read before the Philadelphia Electro-therapeutic Society, Thursday evening, February 12, 1891.

My own trials have been conducted since 1888, and the results published from time to time since then.[1] The drugs made use of have been cocaine, chloroform, menthol, aconitia, onabain, strophanthin, carbolic acid, strychnine, succinimide of mercury, corrosive sublimate, iodol, iodide of potash, helleborin and the citrate, benzoate and chloride of lithium. Within a very short time experiments have been carried on by Cagney, of London, Gärtner, of Vienna, and Edison, in this country, with the results of all of which you are doubtless familiar.

When my first paper was read before the Section in Theory and Practice, of the New York Academy of Medicine, the cataphoretic power of the galvanic current was still so little understood, that considerable incredulity, if not positive disbelief in the existence of such a power, was manifested by some who participated in the discussion. But so much has been accomplished since then, that there is no longer any doubt as to the actual diffusion of drugs in solution through the skin, and into the subcutaneous tissues by the galvanic anode, and it only remains to be established what actual therapeutic value over and above any other means of administration this particular method may possess, and to what disorders it may be especially applicable.

One of the reasonable criticisms has been, that even if drugs were diffused as stated, exact dosage was impossible; but this is no longer a valid objection, since, very recently, it has become possible to make the doses accurate and certain.

A number of electrodes have been devised for cataphoretic purposes, some of them quite complicated, like those of Adamkiewicz, Munk, and my own. But these are now no longer necessary. The cataphoretic electrode should be very simple—an ordinary metal one, either with or without a covering of cloth or sponge. Electrodes of tin are the cheapest, and the oxides may be easily scraped off when they collect. Gold or platinum would be better, but are very expensive, about equally so.

The ordinary sponge electrodes may be employed with solutions, such as those of lithium, iodide of potash, iodine, and the like, where precision in dosage is not required; the plain metal ones, however, for the more careful administration of medicaments like cocaine, aconitia, strychnine, and helleborin. A narrow rim of rubber around the metal surface is needed to prevent evaporation. A disc of cotton cloth, or tissue or blotting paper, may be cut to fit the metallic surface, and upon this is dropped any desirable quantity of the drug in solution. The wet disc of paper is next the skin and prevents burning.

It is sometimes useful to prepare the skin a little before treatment, by rubbing with ether, to dissolve out the oil globules. The anode being applied with the drug, the cathode may be placed anywhere upon the surface of the body, and a current of any endurable strength turned on. The stronger the current the speedier the effect.

Besides the use of these simple electrodes, it is often desirable to make more extensive applications over wider areas. If, for instance, it were wished to diffuse a solution of lithium about a large joint like the knee, a sufficiently large strip of zinc is covered with sponge or cloth saturated with the solution, tied around the extremity, to be then connected with the anodal rheophore. For diffusion through the whole body a bath-tub is used, one either constructed for the purpose or any ordinary bath-tub. The common bath-tub of our houses is readily converted into an anode by placing a large sheet of zinc on the bottom, and connecting it with an insulated copper wire. The sheet of zinc is then covered over with a board to prevent its contact with the body. When the patient is immersed in the bath, he merely keeps one arm out to grasp the cathode, and the circuit is made.

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[1] Electric Cataphoresis as a Therapeutic Measure, *N. Y. Medical Journal*, April 27, 1889.

Note on a New System of Exact Dosage in the Cataphoretic Use of Drugs, *N. Y. Medical Journal*, November 15, 1890.

Farther Studies of the Therapeutics of Anodal Diffusion, *N. Y. Medical Record*, January 31, 1891.

These are in brief the means by which drugs are introduced into the body, and it is clear that any soluble agent may be employed in some one of the ways described. The poisonous medicaments, which are to be administered in accurate doses, are kept either in solution (cocaine 10 to 20 per cent., helleborin 1 per cent., etc.), or discs of filtering paper impregnated with solutions and dried, and containing a known quantity of the remedy, are kept on hand for the purpose. Such cataphoretic discs may be made by any pharmacist.[1]

As regards now the therapeutical advantages of anodal diffusion, it would seem as though it had its widest applicability in maladies of the skin and mucous membranes, or of immediately subjacent tissues ; but, of course, it may be given a much greater scope in conjunction with mineral, antiseptic and alterative baths, which is a problem for the investigations of others in the future.

Dermatologists have already evinced considerable interest in the subject, but I have no doubt that the rhinologist, laryngologist and gynecologist who have so much dealing with mucous membranes, will, in the course of time, avail themselves profitably of a power which promises so largely.

Surgeons have employed it frequently and successfully for local anæsthesia in minor surgical operations.

The physician cannot fail to take up the particular line pointed out by Edison, and make use of local applications by means of sponges, or general by means of baths, for the purpose of influencing local and systemic affections like gout and rheumatism.

I was led myself into making a study of electric cataphoresis by my own work in a neurological line, and my first experiments were conducted with a view to relieving pain. I received the suggestion after vainly endeavoring to combat severe supraorbital neuralgias in several patients. All known appliances and agents of the healing art had been ineffectual, blistering, electricity, aconitia, and the progressive series of narcotics and anodynes, which generally terminate with the morphine habit. One of the patients had suffered from morphine inebriety for a year, but had recovered from that with her supraorbital anguish unassuaged. I found that ten to twenty per cent. solutions of cocaine on the anode gave absolute relief in these cases for from four to ten or eleven hours, and without constitutional effects of any kind. A deep analgesia was produced in the area covered by the anode. No doubt constitutional effects would ultimately result by indefinite continuance of the application.

Since that time I have made it a point always to use the cocaine solution in any sort of superficial pain in which I think the anode to be of advantage. The method does not mitigate neuralgic pains which owe their origin to lesions far back of the point to which the electrode is applied, as in disease of the Gasserian ganglion, or the idiopathic neuralgias of central origin ; and it is here that cocaine cataphoresis has an actual diagnostic significance. If the pain is relieved by the treatment, the lesion is in the immediate neighborhood, or peripheral to the anæsthetized area, and this would furthermore suggest the possibility of permanent cure by neurectomy. This idea of the diagnostic value of cocaine cataphoresis is Dr. Starr's, and it has some sort of corroboration in a case of intense supraorbital neuralgia which I lately saw with him. A 20 per cent. solution of cocaine used with a strong current for a considerable period of time did not diminish the paroxysms of pain in the least. A few days afterward neurectomy was performed, and this also had no effect upon the neuralgia.

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[1] Otto Boeddiker, pharmacist, 954 Sixth avenue, New York makes them for my use.

Cocaine employed in this way does not *cure* neuralgias of peripheral origin. All that is claimed for it is that it gives relief without producing constitutional effects, and is, therefore, superior to any narcotic given internally, and to any other local application.

Other local anæsthetics are chloroform, aconitia, onabain, strophanthin (Arnaud's), helleborin, menthol, and carbolic acid.

Chloroform causes a dermatitis, and should be used only when counter-irritation is desired in conjunction with a transitory anæsthesia. I have employed chloroform cataphoresis in one case of cervical neuralgia with good effect. Helleborin and aconitia I have also used successfully, but the latter, while it gives rise to a deep analgesia, also causes painful smarting and burning, unless combined with a cocaine solution.

While my experience with the method has been chiefly in neuralgias of superficial nerves, I have not failed to give it a trial in other conditions where it seemed to be expedient. I have been using cocaine and helleborin with the anode in two cases of tic convulsif of late, placing the electrode over the trunk

of the facial or one of its branches. Whatever may be the explanation of its effect, these cases certainly show very great improvement, and a remarkable diminution of the spasm after each application, such as was not obtained from the employment of the electric current alone. In a case of blepharospasm, cocaine cataphoresis practised near the outer angle of the eye produced a very marked change in the extent and frequency of the movement. I have no doubt, however, that the results would be better still if we had some drug to use with the anode which would act upon motor nerves in the same way as the local anæsthetics act upon sensory nerves; if, in other words, we had some trustworthy local paralytic. Atropia and curarin do not seem to answer the purpose.

There can be no doubt that the effects of the galvanic current upon nutrition are in part due to the cataphoretic transfer of molecules of protoplasm and liquid from one cell to another, or from a cell to a capillary vessel in the path of the anodal stream, and since the diffusion takes place more readily and more quickly in direct proportion to the current strength, it behooves us to employ as many milliamperes as feasible in our galvanization of the atrophied and paralyzed extremities of poliomyelitis, chronic neuritis, and peripheral nerve trauma. Moreover, there would seem to be a possible advantage in the use of nutritive emollients in conjunction with the labile application of the anode to the atrophied member, just as they have been combined from time immemorial in the exercise of the aliptic art (massage.)[1]

As a last word let me say that while the constant current has proved so useful to the medical profession for diagnosis, for stimulating nerve and muscle, for electrical endoscopy, for cauterization, we must not neglect its cataphoretic property, by which remedial agents are diffused through the tissues and fluids of the body to improve nutrition, to produce anæsthesia, to relieve pain, to destroy germs, to modify morbid processes, and to make soluble chemical combinations with deleterious substances which frequently collect in the organism.

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[1] The Aliptic Art. By Frederick Peterson, M.D. *Philadelphia Medical News,* August 11, 1883.

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TWENTY YEARS' RETROSPECT

IN THE

Treatment of Urethral Strictures by Electrolysis

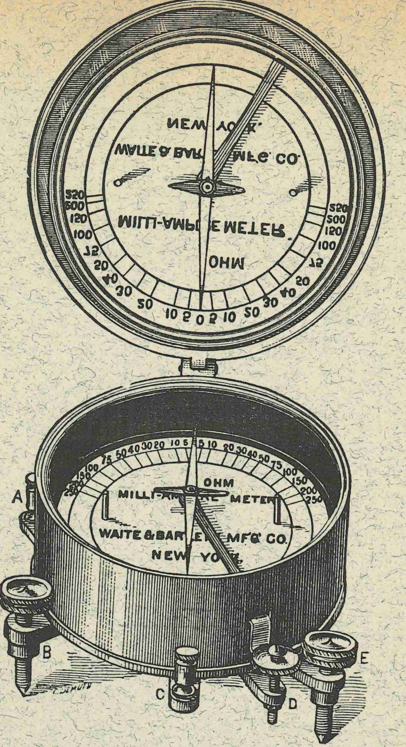
WITH DEMONSTRATIONS.

BY

ROBERT NEWMAN, M.D.,

Consulting Surgeon Hackensack Hospital and Bayonne Hospital.

FROM THE
JOURNAL OF ELECTRO-THERAPEUTICS,
January, 1891.



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TWENTY YEARS' RETROSPECT IN THE TREATMENT OF URETHRAL STRICTURES BY ELECTROLYSIS, WITH DEMONSTRATIONS.*

BY ROBERT NEWMAN, M.D.,

Consulting Surgeon Hackensack Hospital and Bayonne Hospital.

I have chosen the subject for to-night's paper at the particular request of members of this association, who, having read former articles written on this subject, take a deep interest in the method, and desire to see the *modus operandi* with the instruments used practically demonstrated.

It is now almost nineteen years since I communicated my first experience with electrolysis in the treatment of urethral strictures, and since that time I have not read a paper on this subject before a New York City society; and it seems almost that in this city of New York this method is less practiced and less understood than elsewhere in the United States. As this paper is rather long, I propose to make use of the limited time allotted by passing over theories and beginning at once with demonstrations.

Theory.—Electrolysis is the decomposition of a compound body by electrictty—a chemical decomposition. The body to be decomposed must possess certain elements to be an electrolyte, and as a compound body must contain water and a salt. In combination with this chemical action is the cataphoresis, which by some authors is considered an important factor in electrolysis. The explanation lies in the direction of the current, interpolar, between the elements from zinc to carbon, or the current from electro-negative to the electro-positive. In the external current between anode and cathode the direction of the current is opposite, and the particles of the fluid gather at the electro-negative pole, which is the cathode.

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* Read before the New York County Medical Association, December 15, 1890.

Nicholson and Carlisle discovered this process of electrical decomposition in 1800, and successfully electrolyzed water into oxygen and hydrogen ; therefore the theory is not new, and the explanation can be found in any text-book on elementary physics and chemistry. Only the galvanic current can be used for this purpose.

The art of applying electrolysis successfully in surgery consists in :

1. Using the correct strength of the electric current.
2. Applying the respective poles in the right place.
3. Selecting the size, shape, and material of the electrode.
4. Regulating the duration and intervals of seances.

Electrolysis applied with a mild current will cause absorption only,—a galvanic, chemical absorption,—while a strong current will burn, cauterize, or even destroy tissues. Therefore the operator must know what effect he wishes to produce, and graduate the strength of his current accordingly. The management of the operation must be such that every possible mishap is anticipated and prevented.

ACTION OF POLES.—TESTS FOR THE IDENTITY OF EACH POLE.

We have five principal tests.

1. *Water Test.*—The simplest and best method is to immerse two electrodes in the form of platinum needles in water, and you will see the hydrogen at the negative pole, which shows itself in distinct bubbles like pearls around and above the needle, sparkling almost like carbonic acid in an effervescent.

2. *Meat Test.*—The poles of the battery in the shape of two needles (platinum are best) are inserted in a piece of fresh raw meat. After electrolytic action has been allowed to take place for a while, the difference in pole action can readily be observed. The positive pole makes the meat black around the needle, chars, and almost destroys it ; at the negative pole the color is different, nearly white, and bubbles of hydrogen can be seen.

The action of the poles is very different in electrolysis, hence each has its own function.

The positive pole attracts the acids and the oxygen from the tissues and coagulates blood.

The negative pole attracts the alkalies, hydrogen, and the base of the salt, dissolves blood (but forms a plug from froth of the hydrogen), coagulates albumen, and causes absorption.

Hence the positive pole acts like an acid, and burns like fire, which is not only exceedingly painful, but may leave a hard, resilient cicatrix. On the other hand the negative pole acts more like a caustic alkali, which does not hurt so severely during the application, and leaves, if carried to excess, a cicatrix which is soft and not retractile. From this it is evident, that for the immediate destruction of tumors and for treatment of strictures the negative pole should be selected. Electrolysis requires the presence of water, and that you will find in every tissue.

As it is vitally important to distinguish the poles, and as we cannot trust to the marks of the instrument-maker, we must always ascertain which is the positive and which the negative pole.

The positive pole is noiseless, the litmus paper applied to it shows an acid reaction, and the needle adheres firmly to its surroundings in the meat; the needle of the negative pole sticks loosely in the meat, can easily be removed, and during electrolysis a hissing sound proceeds from it.

A piece of fresh meat still contains water enough to be an electrolyte, while the living body in which the circulation is active, is better, and a dried-up piece of meat is no electrolyte. I have made practical experiments on dogs, on pieces of meat and pathological specimens, particularly with carcinoma. From among them I will mention the following:

(*a*) Into a piece of fresh raw pork two large platinum needles were inserted, at a distance of three inches. The current from a galvanic battery of thirty-five cells was allowed to pass for fifteen minutes, after which time the meat between and around the needles was thoroughly changed into a soft pulp. A weaker current caused changes proportionately; the current of five cells produced distinct effects in five seconds, twenty cells in one second.

(*b*) Into a piece of meat containing a bone in its center the needles were inserted at a distance of two and a half inches from each other. One large platinum needle was then connected with the positive pole, while with the negative pole two small steel needles were connected. These needles were inserted close to the bone, and one directly into the bone cells. The galvanic current of thirty-five cells in fifteen minutes produced changes in the entire tissues, so that the bone around one negative needle was entirely destroyed.

3. *Decomposition of a Salt.*—If, for instance, a solution of iodide of potassium be subjected to electrolysis, one equivalent of iodine, liberated at the positive, will have one equivalent of hydrate of potassium liberated at the negative pole, showing that the potassium liberated from combination with the iodine has combined with some of the surrounding water. This can be illustrated by simply holding both poles in the solution while the galvanic battery is in action.

The experiment, however, which we will now make before you is more strikingly demonstrative and I believe is original with me. These two small glass vials are filled with a solution of iodide of potassium. For the bottoms of the vials a piece of pig's bladder is substituted; the necks are then stopped by a cork, through which runs a platinum wire, one end of which is immersed in the solution, and the other attached to a pole of the galvanic battery.

Both vials, so closed, are now placed in a dish of water; they are six inches distant from each other. There is, as is seen, no communication between them except the water, and so long as the battery is at zero you will see no change in the solution, which is transparent and undisturbed. Please notice the change which now takes place as soon as the battery begins to act. We begin with only six cells, and you will notice almost immediately in the vial connected with the positive pole, that in the clear solution streaks of yellow appear, and in about five minutes the vial will contain only a dark yellow fluid, which is the iodine set free at this pole. At the negative pole the contents of the vial remain clear, only bubbles of froth welling up. This is the hydrogen set free from the water. The result of this electrolysis is iodine, oxygen, and hydriodic acid at the positive pole, while at the negative pole we find hydrogen and potassium.

If this same experiment is tried with a faradic battery, as I have often verified, no change whatever takes place in the solution. This is another proof that the action of the galvanic current is widely different from that of the faradic, and that for electrolysis a galvanic current only can be used.

4. *Tests by Galvanoscope* (*or Milliampèremeter*).—If the two electrodes are brought in contact with each other the needle will deflect toward the positive pole.

5. *Stammers's Polarity Distinguisher* is a simple and practical test. It is constructed on the principle discovered by Oersted, that the magnetic needle tends to assume a position at right angles to the direction of the electric current. This little instrument shows the positive pole by the appearance of the red color in either fenestrum as soon as the poles are held in contact with the instrument.

SIZE AND MATERIAL OF ELECTRODES.

The size of the electrodes will concentrate or diminish the force of the electricity accordingly; therefore,

an electrode of large size is indicated if the respective pole is used merely to close the circuit, etc.

The material of the working electrodes may be metal, such as brass, copper, or silver. This is the negative pole, the bulb is egg or acorn shaped.

The material of the positive pole, used here to close the circuit, is of brass or carbon, covered with sponge or absorbent cotton.

MEASUREMENT AND UNITS OF ELECTRICITY.

At the present stage of progress it is imperative to measure currents used for electrolysis. The milliampèremeter (Fig. 8.) is the instrument used for that purpose. For a better understanding, and to make this part of the paper more complete, I make here a brief mention of units in electric nomenclature. The term "legal" is applied to the units adopted by the Paris Electric Congress in 1881, hence the following are the practical legal electric units, based on the C.G.S. system.

A volt is the unit of electro-motive force, the measure for pressure of difference of potential. It is nearly equal to one cell of Daniell's battery.

The ohm is the unit of resistance, or rate of velocity, the standard of which is a column of pure mercury one square millimeter in cross section, and 106 centimeters in length, at the temperature of oC.

An ampère is the unit of current strength or volume; the standard measure of the electric current. An ampère is equivalent to the strength furnished by an electro-motive force of one volt, passing through a resistance equal to one ohm $C = \frac{E}{R}$

A coulomb is the unit of quantity. It is equal to one unit of current ampère passing in one unit of time (one second); or in other words a current of one ampère in a circuit will produce one coulomb in a second.

A watt is the unit of energy or force, or equal to a combined volt and ampère.

One horse power is $\frac{\text{amp. x. volt.}}{746}$

A farad is the unit of capacity. It represents the storage of one coulomb of electricity in a condenser.

A joule is the unit of heat; it also represents the work done by a watt in a second.

For over twenty years I have treated successfully all strictures of the urethra by electrolysis, without having used internal urethrotomy in a single case. Several hundred cases have been published. Many hundred cases are on record, and no record has been made of many more treated in public institutions.

MODUS OPERANDI.

The topography of the urethra should first be well ascertained, and the strictures measured, and a plan for the operation made, with a full knowledge of what it is intended to accomplish. The patient's susceptibility to the galvanic current is to be learned by applying it to the hand or some other part of the body. The posture which the patient should assume during the operation is a matter of slight importance; according to his convenience, he may stand, sit, or lie on his back, with his shoulders elevated and his knees drawn up. Anæsthetics are not used, for no pain should be caused, and the patient should be conscious, so that he can express his sensations. For ordinary strictures, the size of the bougie selected should be three numbers (French) larger than the stricture. This bougie electrode is then to be introduced into the urethra until the bulb is arrested by the stricture. A sponge electrode, wet with warm water and connected with the positive pole of the battery, is to be held firmly against the patient's skin, either in the palm of the hand or pressed against the abdomen, the thigh or some other part, to complete the circuit. While both poles are held in this manner, the current should be increased very slowly and gradually, one cell at a time, until the patient feels a warm and slightly pricking sensation, the current being measured at the same time. The operator must keep the bougie steady against the stricture, and he will soon find that absorption is taking place, that the stricture yields, enlarges, and the instrument slowly advances and passes the obstruction. At times it will fairly jump through the stricture. If there are more strictures than one, the bougie should be guided in the same way until it enters the bladder. Then the electrode is to be withdrawn slowly, and each stricture well worked out, until the first stricture is repassed, when the current is again to be reduced slowly, cell by cell, to zero; and then and not till then is the electrode to be removed. During the whole operation the electrode must be held loosely and gently in its place against the obstruction, all pressure or force being avoided. The bougie will take care of itself, doing its work by the electrolytic action of the current. A seance may last from five to twenty minutes.

In order to show the usual progress, the history and treatment, two cases are here given as a type. Both were of unusual severity and long standing. They were cured, and in five and three years respectively no relapse has taken place.

Case I.—*Three strictures of twenty-six years' duration; retention; cure; no relapse.*

T. D., æt. fifty-six, New York, married. January 22, 1886, was sent to me by Dr. C. S. Wood. Has had stricture for twenty-six years. In 1860 a doctor caused him agonizing pains by using a strong injection, which appears to be the cause of his stricture. Has been treated by dilatation off and on. Of late has had spasm of the bladder and distension, so that he could not void urine voluntarily. The urine dribbled away by overflow and most of the time he had to use a catheter. The stricture closed up more and more till he could neither pass a catheter or void urine. On examination three strictures were found 3½, 6½, and 7½ inches respectively, from the meatus. The last two were impassable. With difficulty a filiform guide was introduced. Electrolysis, No. 9 French, tunneled, with combination over guide, passed all strictures.

January 27.—Electrolysis was repeated with a No. 11 French tunneled, over a filiform guide (5 milliampères 10 minutes). In the evening came to the house in distress, with retention; was not able to pass water. A syphon arrangement was made and urine drawn off drop by drop. In this manner one and one half pints of muddy urine evacuated, putrid, and loaded with pus.

January 28.—At 10 A.M. had not been able to pass water. The bladder had been distended to such an extent that it had lost its contractile power. A small catheter was passed, and assisting with syphon at intervals, during one and one half hours fifty-three ounces of urine were emptied from the bladder. This urine was thick, putrid, with solid masses of disorganized, stinking pus. At 6 P.M. bladder would not act; flexible catheter would not pass. A small silver catheter was introduced on a guide and twenty-four ounces of water drawn off, which had a better color, was clearer, and contained little pus.

January 29.—Faradization of bladder, after which he could pass water. While a guide was in the urethra twenty ounces passed. Bladder washed out; the urine is improved.

January 30.—Micturition voluntarily.

February 1.—Electrolysis No. 14 French, egg-shaped, tunneled over guide, 4 milliampères, 7 minutes.

February 3.—Bladder washed out and dilated.

February 5.—Electrolysis No. 17 French, egg-shaped bulb, tunneled over guide, after which he passed a better stream.

February 11.—Micturates now voluntarily, says he has not passed so good a stream in twenty-six years.

February 13.—Electrolysis No. 18 tunneled electrode passed very tightly.

February 17.—Now empties the bladder voluntarily and with ease, and no residue is left.

February 27.—Electrolysis No. 20 French, straight acorn bulb.

March 16.—Electrolysis No. 21 French.

May 31.—Electrolysis No. 23 French, passed well.

The treatment by electrolysis and washing out the bladder was continued in the same manner till July, when a No. 25 French sound passed easily into the bladder and patient felt well, having regained full power of his bladder. He objected to further treatment or a larger caliber of his urethra, as he was perfectly content with his present state of health and comfort.

One year after was re-examined; no relapse.

1889, November 24 (three years after), re-examined with the same result.

1890.—In perfect health.

CASE II.—*Four strictures, of eighteen years' duration Traumatism*; *cure; no relapse.*

H. K., æt. forty-two, married, New York City. Has had strictures for eighteen years, caused by former urethritis and accidents. Has also suffered from cystitis; received a kick in the perineum by accident. Once he used a sound so forcibly that he ruptured the urethra. Has been treated off and on, mostly by gradual dilatation, without much benefit.

April 9, 1886.—Examination. *Bougie à boule* meets slight indurations and thickenings of the walls of the urethra, and is arrested at 5½ inches. Sound No. 12 will not pass this stricture. A filiform guide passes easily into the bladder over which a tunneled sound, No. 9, ran tightly by electrolytic action. There were four strictures at 4, 5¼, 6¼, and 7¼ inches from the meatus.

April 15.—Electrolysis; filiform guide, over which a tunneled electrode, No. 11 French, egg-shaped, was used, 4 milliampères for 8 minutes. It passed through all strictures; the hard ring stricture at 6½ inches, was overcome by slow manipulations and lowering the curve of the instrument. Dr. Lawson was present.

April 22.—Electrolysis with a No. 14 French egg-shaped bulb, tunneled over a filiform guide; 7 cells were used with a current of 4 milliampères for 15 minutes. Progress was very slow, but steady, and electrode passed all strictures.

May 19.—Electrolysis over a filiform guide with a tunneled No. 17. Took 15 minutes to open all strictures. Current 4½ milliampères.

May 26.—Electrolysis No. 18 French, egg-shaped bulb, no guide; 10 minutes, 3½ milliampères current passed all strictures slowly and steadily.

June 2.—Electrolysis with a No. 20 French, passed easily into bladder, 8 minutes, 4 milliampères.

June 9.—Electrolysis with a No. 23 egg-shaped bulb; 8 minutes, 4 milliampères passed.

June 17.—Electrolysis No. 25 French, 9 minutes, 4 milliampères.

June 30.—Electrolysis No. 28 French, passed slowly and rather tightly.

July 14.—Electrolysis with No. 28 French, egg-shaped bulb, passed easily.

October 6.—Was re-examined with a No. 28 French, and urethra was found well; no trace of strictures found.

1888, May.—Well. On re-examination with a No. 28 French electrode found well, without any relapse.

1890, December 12.—Dr. Lawson reports that patient died about a year ago in Sharon Springs from rheumatism, with failure of heart, but that the strictures remained cured, without any relapse.

The treatment of this case was typical in regard to its regular progress at each seance, etc.

INSTRUMENTS.

One set egg-shaped bulb electrodes, Fig. 1; one set short, acorn-shaped bulb electrodes, Fig. 2; one set tunneled electrodes, Fig. 3; some combination electrodes, Fig. 4; *bougies à boule*, Fig. 5; filiform guides, Fig. 6; galvanic battery, Fig. 7; one milliampère-meter, Fig. 8; a few conducting cords; two handles carbon covered, as electrodes; two or three binding screws, Fig. 2.

These instruments are well made by Waite & Bartlett, Geo. Tiemann & Co., Henry E. Stammers, and others.

Some manufacturers make very faulty instruments, and even a low price is no recommendation for a useless or dangerous article.

1. *The egg-shaped set*, Fig. 1.—The regular electrodes for all ordinary cases have a short curve, an egg-shaped metallic bulb at the working end, while at the upper end there is a round wire rod for the binding screw of the negative pole of the battery; the only point not insulated and acting as conductors are these extremities. The rest of the electrode must be well insulated, smooth, and without inequalities. I consider a conical bulb objectionable in most cases, as we depend on the electrolytic power of absorption, not on force. The length of the bulb is proportioned to the size of the electrode; thus, for No. 11 French it is $\frac{3}{16}$ inch, while for No. 21 it is $\frac{3}{8}$ inch. The set consists of Nos. 11, 14, 17, 18, 20, 21, 23, 25, 28, and 30 of the French scale.

2. *The acorn set*, Fig. 2.—These are for use in the first six inches of the urethra in certain cases, and consist of Nos. 15, 17, 20, 22, 25, 27, French. They

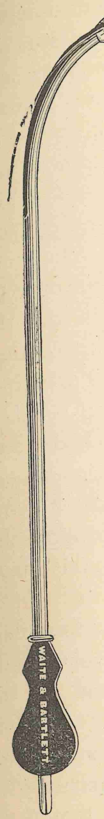

FIG. 1.

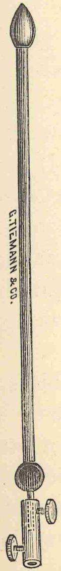

FIG. 2.

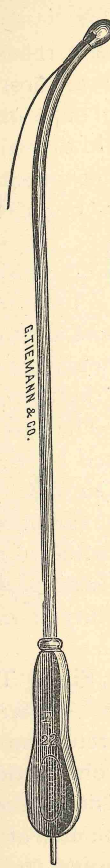

FIG. 3.

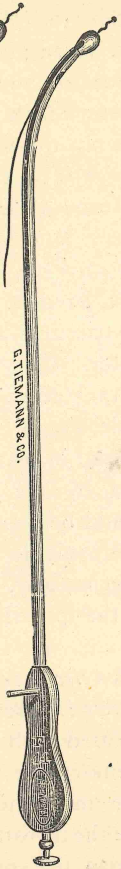

FIG. 4.

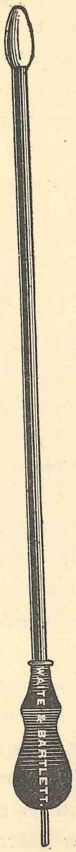

FIG. 5.

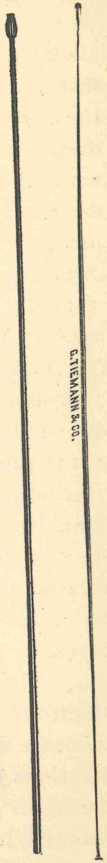

FIG. 6.

are without a curve, short, and the bulb is acorn-shaped. Sometimes it is desirable to gain ground by entering the contraction first with the point of the electrode, in order to follow more easily with the larger part of the acorn ; here this form will do good work. The action of the electrolysis depends on the largest diameter of the bulb in these cases, and does most service on the withdrawal of the electrode when the operator *feels* best how much work should be done. It is also used when the stricture is near the meatus.

3. *The tunneled electrode*, Fig. 3.—These are in Nos. 9, 11, 14, 17, 20, 21, French. They are very important for bad, tortuous strictures, and are to be used only by the expert operator. The curve is shorter and the egg-shaped bulb tunneled so that it may be introduced over a filiform guide, Fig. 6. They are on the principle of the tunneled sound invented by Dr. J. W. S. Goulay, and were devised by me so that electrolysis and tunneled sound could be used simultaneously. Where the stricture was impassable with ordinary instruments this was used successfully, and passed through the stricture without the possibility of making false passages.

4. *The combination electrode*, Fig. 4. This is a tunneled electrode for extreme cases. Where a very tight stricture is complicated with retention of urine, the indications are to remove the obstruction and draw off the water with one instrument, as the parts are too sensitive to tolerate the introduction of two instruments in succession. Also, the patient may be benefited by washing out the bladder, all of which can be done with one introduction of the instrument. The *bougie à boule*, Fig. 5, is used for preliminary examinations to detect the strictures and their location.

The galvanic battery, Fig. 7.—Any good galvanic battery answers our purpose if the current is steady without giving shocks by interruptions. A large surface of battery will cauterize with more intensity than any other known caustic, and by using the necessary amount of electric current thus generated, the sphere of action is enlarged and too much inflammation of the surrounding healthy tissues may supervene, thus aggravating the disease. No action should ever destroy healthy tissue, and the concentration of the electric current should be strictly confined to the diseased locality. The battery works to advantage—

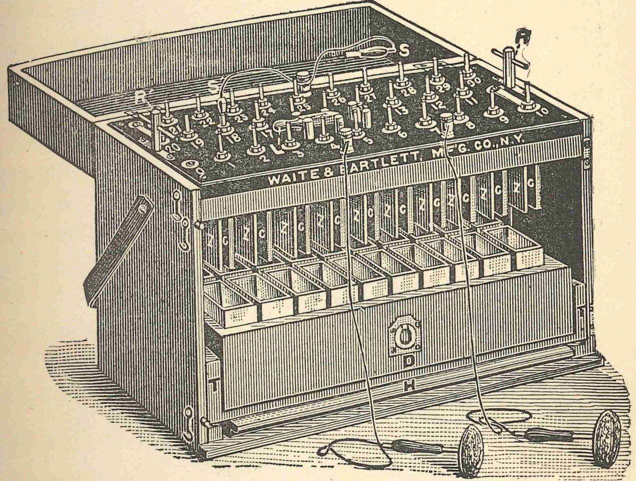
WAITE & BARTLETT, MFG. CO. N.Y.
S
R
S
D
H
T

FIG. 7.

1. The intensity of the current can be augmented

gradually, cell by cell, without any interruption of the current, so that the patient will hardly perceive the increase of intensity.

2. The quantity of electricity is reduced to a point sufficient to produce the most intense action on a very limited space. I generally use a carbon-zinc battery. The make is immaterial so long as the current is steady, the slide easily moved without interruption of the current. The cells I have had made of hard rubber, which are preferable to glass, because they are lighter, do not break so easily, and, on account of their thinner walls, contain more fluid.

The milliampèremeter, Fig. 8, has been mentioned before under "Measurement of Electricity." As the expense for this instrument is small, and its use nowadays absolutely necessary, every operater should possess one.

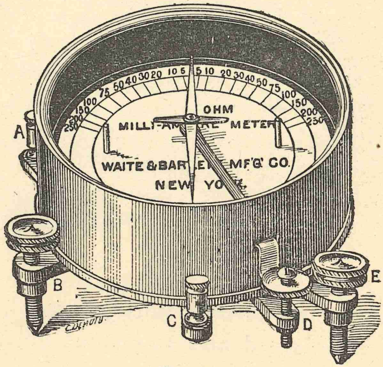

FIG. 8.

Recapitulation of rules, as a safe guide for practitioners who wish to adopt the treatment of electrolysis in strictures of the urethra :

1. Any good galvanic battery will do which has small elements and is steady in its action ; the 20 cell battery zinc and carbon elements is an excellent instrument and sufficient for the beginner.

2. The fluid for the battery ought not to be used too strong.

3. Auxiliary instruments are important to the expert, but not necessary for the beginner. However, a milliampèremeter to measure the current is now imperative.

4. For the positive pole a carbon electrode is used, covered with sponge, moistened with hot water and held firmly against the cutaneous surface of the patient's hand, thigh, or abdomen.

5. For the absorption of the stricture the negative pole must be used.

6. Electrode bougies are firm sounds, insulated with a mass of hard-baked rubber. The extremity is a bulb, which is the acting part in contact with the stricture. Four varieties are now in use.

7. The curve of the electrode should be short ; large curves are mistakes.

8. The plates must be immersed in the fluid before the electrodes are placed on the patient, and raised again after the electrodes have been removed.

9. All operations must begin and end while the battery is at zero, increasing and decreasing the current slowly and gradually one cell at a time, avoiding any shock to the patient.

10. Before operating, the susceptibility of the patient to the current should be ascertained.

11. The problem is to absorb the stricture, not to cauterize, burn, or destroy tissues.

12. Weak currents at long intervals.

13. In most cases a current of six cells, or from two and a half to five milliampères, will do the work, but it must be regulated according to the work to be done.

14. The seances should be at intervals, not too frequent in succession, about once a week average; and each lasting from five to twenty minutes.

15. The best position for the patient to assume during the operation is that which is most comfortable to himself and to the operator. I prefer the erect position, although the recumbent or others may be used.

16. Anæsthetics I like to avoid; I want the patient conscious, so that he can tell how he feels. Sometimes and exceptionally cocaine may be used.

17. Force should never be used; the bougie must be guided in the most gentle way; the electricity alone must be allowed to do the work. Avoid causing hæmorrhage.

18. During one seance two electrodes in succession should never be used.

19. All strictures are amenable to treatment by electrolysis.

20. Pain should never be inflicted by the use of electrolysis; therefore it should not be applied when the urethra is in an acute, or even sub-acute inflammatory condition.

21. The electrodes should not be greased with substances which are non-conductors and would insulate.

22. For ordinary strictures, the size of the bougie selected should be three numbers (French) larger than the stricture.

Since my method has become popular, some instrument makers have sold an inferior and faulty article

by the thousand, and very cheap. Some have even manufactured at random instruments which they sell as Newman's electrodes, for which I am not responsible, and deny most emphatically the parentage. I have seen many defective instruments with which nobody could perform the operation correctly. For such and many other reasons, it is a wonder that more failures are not reported. Electrodes in which the metal bulb is screwed to the stem are always dangerous, and should never be manufactured.

THE ADVANTAGES OF ELECTROLYSIS.

1. Electrolysis is applicable to all strictures in any part of the urethra.

2. Electrolysis will pass and enlarge any strictures, when other instruments or the skill of surgeons fail, which I have often demonstrated.

3. It causes no pain or inconvenience.

4. It is devoid of danger.

5. It is not followed by hæmorrhage, fever, or any other unpleasant consequence.

6. It relieves at once.

7. The patient is not prevented from attending his daily work or business, and can earn his living, while under treatment, without restraint.

8. No relapse takes place.

DIFFERENCES BETWEEN THE PRESENT AND THE OLD METHOD OF ELECTROLYSIS.

From the foregoing description it will be seen that the present method, as practiced for the past twenty years, differs in many points from the method used between the years 1847 and 1870. The medical press and authors of the last decade have kindly acknowledged this, and the following comparison will illustrate these differences :

OLD METHOD.	NEWMAN'S METHOD.
I. CURRENTS.	
Strong currents, which acted as a cautery, destroyed tissue, and formed a cicatrization.	Weak currents, which absorb by a chemical decomposition without causing cauterization or cicatrices.
2. INTERVAL BETWEEN SEANCES.	
Short intervals, causing new inflammations, *coupe à coupe*.	Long intervals, preventing inflammation and allowing restitution.
3. SELECTION OF BATTERY.	
Batteries without a fixed potential, large cells, large elements, strong acid fluid, causing cauterization. N. B.—Some operators, however, have used smaller elements.	Improved batteries, with a current of moderate intensity, but a fixed potential on which depends the results ; too high a potential is injurious ; too low a potential is ineffective.
4. ELECTRODES.	
Uncertain copper wires covered by an elastic catheter, uncertain in action.	An established electrode, firm, well polished, with an egg-shaped bulb, a fixed short curve, well insulated, except at the ends.
5. TUNNELED ELECTRODES.	
No tunneled electrode. No filiform guides. False passages possible.	The electrode sound tunneled, in order to combine the electrolysis with the passage on a guide, to be used in almost impassable strictures, making false passages an impossibility.
6. THE COMBINATION ELECTRODE.	
Formerly, in some cases, the dilated bladder was not relieved, and remained unable to empty the urine voluntarily.	An emergency instrument, adapted on modern principles, combining the electrode with a tunneled sound and a catheter, in order, at the same time, with one introduction to relieve retention, to absorb and dilate the stricture, and guide the instrument through the right channel, making false passages an impossibility.
7. POLES.	
	Use of negative pole and no catheterism between and after seances.

A graphic description of the old method is given by Dittel in his work on Strictures, p. 173, in which he distinctly says that he used the positive pole (copper) to the stricture, and the negative (zinc) external on the limbs ; that he destroyed the stricture in one sitting by cauterization. No wonder that such a method failed and was condemned by him.

French operators of the old method called it a "galvano-caustique," which also proves that they intended to cauterize with strong electric currents. It is unfortunate that even nowadays many are so impressed with the old method that they do not take the trouble to read and perceive the difference between the new method of chemical absorption and the old of "cauterization." Such mistaken ideas are in part the reason, why some make objections to a method they do not understand.

OBJECTIONS.

In reality there can be no valid objections to the use of electrolysis in the treatment of urethral strictures, and those which have been raised from time to time came either from men entirely ignorant of the fundamental physical laws of electricity, or from those who had a personal interest or feeling in the matter. To the latter class of the opposition belong some surgeons of high standing, who are wedded to the knife, and, not having tested electrolysis, are opposed to any innovation; and even if they knew well the efficacy of electrolysis would cut anyway, because they have been so accustomed for many years. Most of the objections are either entirely unfounded and based on false theories, or are too trivial and ludicrous to be considered.

One friend objects to the treatment, because it does not always cure a prostatitis or any other discharge. Of course, it does not always, and discharges will only be cured if their existence is caused by the stricture; but if there are granulations, or other causes, our electrolytic treatment has nothing to do with it. Some are grieved to hear, that in order to succeed it is necessary to understand electricity and the handling of the genito-urinary instruments. Now there is scarcely a profession, business, or even mechanical pursuit which can be exercised without an apprenticeship, and in any vocation expertness is needed to be successful. The same objection could be raised to any operation, or even to the practice of medicine. If operators who are unskilled or careless fail in their undertakings, it does not condemn an acknowledged good operation. A London surgeon does not like the long intervals between seances, but gives no reason for his dislike. If necessary, he may operate at shorter periods, as I have shown in the report of cases that I

have operated on in intervals of two days. My recommendation of longer intervals is made for the convenience and pleasure of the patient, who generally is made comfortable after one operation, and for that reason I consider long intervals rather an advantage. One of my distinguished friends, who is most persistent in his opposition to my method, argues as follows:

"Electrolysis is a heat; heat burns; burns make cicatrices; cicatrices make every stricture worse; *ergo*, electrolysis is no good." Now that gentleman ought to know better, after having read my articles on the subject, and heard my explanations. I distinctly advise, always practice, and insist upon weak currents of from 2½ to 5 milliampères, so that the electrolysis acts as a chemical decomposition by absorption, which never burns or destroys tissues.

If some gentlemen use too strong currents, or the positive instead of the negative pole, they make gross mistakes, and must necessarily fail. They destroy tissues, and ruin their patients. If professors and others have made such mistakes and failures, it is to be lamented, but does not harm the reputation of a good method, approved by acknowledged successes all over the world in a very great number of cases. It is more than ludicrous to read the report of a crank who has the *naïveté* to measure electricity with a thermometer. While using faulty instruments, which cauterize instead of electrolyze, he shows that the current burns, because the thermometer is marked 95° F. Is that man not afraid to burn everything by the touch of his hands, which certainly must have a higher temperature?

Other similar objections I answer by stating that I have used the endoscope in observing strictures for a period of over twenty years; that I have made experiments on dogs, and have proven my assertions by vivisections, post-mortems, and by a great number of successful cases, many of which have been re-examined after a period of from three to eleven years without a relapse of the cured stricture having been found, and that similar reports and observations have been made by many other surgeons.

Similar objections were raised in London when Drs. Steavenson and Bruce Clarke read a paper on the subject before the Royal Medical and Chirurgical Society, when the report of my 100 cases "without relapse" was alluded to. One speaker sarcastically observed: "It is a very remarkable fact about Dr. Newman's cases that they were all successful." My answer to this was brought out by Dr. Steavenson in an article in the *British Medical Journal*, July 23, 1887, p. 173, as follows: "That critic overlooks the fact, that, in the selections of those 100 cases, the first essential point was that they were discharged as cured, in order to see whether or not a relapse would take place. Those hundred cases were naturally not consecutive cases, but were collected chronologically, and had to meet the following conditions:

1. The patients were to have been under treatment regularly and for a reasonable time.

2. They were to have been discharged as cured, or at least so improved that the patients were content with the result, and did not wish any further treatment or improvement.

3. They were to be cases that were heard of afterward by reliable information, mostly re-examined by

the family physician, or by Dr. Newman himself. Some of these patients came repeatedly for such re-examination.

4. That a reasonable time had been allowed between the discharge when cured and the re-examination, which in these cases was respectively from three to eleven years.

The proof of "no relapse" was that the same sized sound was used in the re-examination which passed the last time at the close of the treatment; that is, if the caliber of the urethra had been enlarged to a No. 26 (French), the same No. 26 passed again after the period of from three to eleven years. All these facts have been distinctly stated, and those skeptical critics have overlooked the facts, and therefore have been unjust.

Why is it advisable to use gradually larger and larger electrodes? This is a question by a gentleman who wants to prove thereby that the enlargement of the caliber was done by pressure. The answer is that the electricity can do only a certain work in a certain time, and that it would be impossible to subject the patient to such increased work, and to such prolongated time in one seance, without doing great harm. You may just as well ask why you eat three meals a day, and why not eat once a week, by taking twenty-one meals at once. It is considered a good result to enlarge the caliber of the urethra by three sizes in one seance. And when such three size larger sound cannot be *pressed* through a stricture, but passes by the action of electrolysis, no pressure being used, it is the best proof that the electrolysis did such work and not a dilatation. This I have often demonstrated. Besides, how can the intelligent interrogator expect that a stricture which will only admit a No. 9 sound, can be taken grip of by a large bulb like No. 28? Such a large bulb, acting as the negative pole, could only enter the healthy part of the urethra with its tip, act there on healthy tissue, which would do harm, and not improve the diseased part. No; we want a size for the electrode, which, with its tip, reaches the beginning of the stricture, engages itself therein, and enlarges the caliber by degrees, by means of its chemical action, until it is sufficiently large that the electrode will pass the stricture, making it three sizes greater than before the operation. According to the nature of the stricture, an electrode two to four sizes larger, French scale, may be used for one seance, and this must be considered a very good result. Another eminent gentleman finds fault that no endoscope has been used, and that American writers have not given enough details with regard to the size, nature and position of the stricture. He also described one case of his own as a failure. No wonder he failed, because he in reality practiced electro-puncture, and not electrolysis, and a contraction naturally followed. Neither are his objections justified, as I have in my tabular statistics, as well as in other reports of cases, stated details, as patients' first visit, cause, duration, complication, nature, number, size and seat of stricture, etc. I also have used the endoscope for twenty years, and made use of it in the treatment of strictures, when it was indicated, to gain further information. I have still to hear of a really valid objection; but on the contrary I can state decided advantages of the electrolysis.

FAILURES.

If the rules in the treatment, as described above, are carefully carried out by the operator as well as his patient, there ought to be no failures, or at least they will be very rare. It is, however, an undeniable fact that failures have been reported, even by medical men in good standing. The cause of such failures in most instances could be traced to bad management, in which all rules of physical laws and surgical dexterity were ignored. In brief, the cause of such failures depends on:

1. The operator: his incompetency, carelessness, want of patience, mismanagement of the case, or a wrong diagnosis.

2. Faulty instruments; and,

3. The patient himself, in not following orders or being tampered with.

In most cases I have pointed out to correspondents the mistakes they made, and some of them succeeded afterward in new trials. I often have seen improperly constructed instruments, which no one would be able to pass through a urethra. It cannot be too much urged to procure the best instruments, even if they cost a little more. The price of a good instrument should be no object, compared with the mischief which a cheap tool can do. In former papers of the writer the causes of failure have been treated more in detail. Among these papers may be mentioned, "Ten Years' experience in the Treatment of Stricture of the Urethra by Electrolysis."* "Is Electrolysis a Failure in the Treatment of Urethral Strictures ?" * "Success and Failure of Electrolysis in Urethral Strictures." † "A Defense of Electrolysis in Urethral Strictures," and a very good article, is written by Dr. G. C. H. Meier. ‡ "Why Electrolytic Treatment of Stricture does not Succeed in all Hands." §

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* New York *Medical Record*, August 12 and 13, 1882.

RELAPSES.

One of the advantages of this operation is, that when a stricture is cured, as a rule no relapse takes place. Many reports by different operators have confirmed this statement, and the perusal of the following papers will be particularly interesting: "Tabular Statistics of One Hundred cases of Urethral Stricture, treated by Electrolysis without Relapse," ‖ a paper read before the section in surgery, at the meeting of the American Medical Association in Cleveland, June 6, 1883, and also "Synopsis of the Second Hundred Cases of Urethral Stricture treated by Electrolysis,"¶ read June, 1887, at the annual meeting of the American Medical Association in Chicago.

These statistics have been explained. A few operators, however, have found in their practice that relapses have occurred, and the question naturally arises whether such reports do not contradict the former statement of the writer, that relapse does not take place. There is scarcely a rule without an exception and there is hardly an operation which may

not sometimes fail from some unforeseen concomitant circumstances. In the operation under consideration relapses are very rare, and when they occur may have been induced by the very same causes which have been mentioned under the causes of avoidable failures, heretofore referred to. It is safe to state that relapse will not occur when the patient has been dismissed as cured. The conditions are that the strictures must be treated until they are cured by having assumed healthy tissues, all the fibrinous, cartilaginous, and cicatricial encroachments entirely removed and the size of the caliber sufficiently enlarged. It is not necessary that the caliber be enlarged to theoretical fancy numbers, and not even to its normal size; but to such a caliber that the patient can comfortably micturate, and that the bladder is not forced to extra exertions and painful contraction in order to relieve itself of the water, which must be expelled for its comfort and rest.

This is generally accomplished after an electrode of No. 25 or 28 French scale has passed easily, but exceptionally some patients may be declared well after the passage of a No. 23, and some other patients need a larger caliber, until they can be dismissed as cured. As many patients absent themselves after an improvement, when they feel comfortable, and without being cured, it is a natural consequence that the stricture will close up again, and such patients return reporting "worse," or go to another practitioner, telling him the electrolytic treatment was followed by a relapse. While such cases have been observed, it cannot be called a relapse in its true meaning.

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* *Medical Record*, September 25, 1886.

† Philadelphia *Medical Times*, December 15, 1888.

‡ *Medical Register*, Philadelphia, January 5, 1889.

§ *International Journal of Surgery*, October, 1888.

‖ *New England Medical Monthly*, August, 1885.

¶ *Journal American Medical Association*, September 24, 1887.

A history of the following typical case will serve as an illustration.

Case IV. *Stricture of fifteen years' standing.*

S. B. B., æt. forty-six years, single, came under my treatment October 17, 1882. Has had successive urethritis, and for years a discharge continued. Is suffering now from strictures of fifteen years' standing. Has been treated off and on by dilatation, with a little temporary relief. Patient is depressed and anæmic; appetite is capricious; bowels regular. At the present time patient cannot urinate in a full stream, and only by straining can make the urine come in driblets. In fact there is an incontinence of urine to such an unpleasant degree that he is obliged to wear a urinal.

Examination.—Bougie à boule meets a mass of hard strictures in succession, through which the bougie, passed only by manipulations and with difficulty. The bougie, a No. 12 French, was arrested by another stricture at 5 inches from the meatus. On further examinations with a small filiform bougie four distinct strictures were found as follows: First stricture at 3½ inches from meatus; second stricture at 5 inches from meatus, very hard and nearly one inch long; third stricture at 6½ inches from meatus; fourth stricture at 8 inches from meatus.

Electrolysis over filiform guide with a tunneled electrode, No. 9 French, as a negative pole in urethra. Eleven cells were used for 7 minutes, in which time the electrode passed slowly all strictures and entered the bladder. Strictures were very hard and tight.

October 27.—Second electrolysis. Filiform guide was arrested and entered lacunæ. Fearing that perseverance with the filiform would cause too much irritation, it was withdrawn.

Electrolysis was applied direct with a No. 14 French, egg-shaped bulb. Seven cells were used; third stricture is very tight, and fourth runs tortuously to the right side. Electrode passed all strictures; operation lasted 8 minutes.

November 3.—Third electrolysis. No. 17 French, egg-shaped bulb passes very slowly, but in 10 minutes had enlarged all strictures and passed into bladder; 10 cells were used.

November 28.—From the commencement of treatment until date has gained fifteen pounds, which brings him up to his normal weight. Urine passes freely; bladder is fully under his control, and the urinal is discarded. He is certainly not cured, but nevertheless will go South to-morrow.

1887.—After five years' absence returns from the South. Has been comfortable for a few years, but strictures have gradually contracted, so that on presentation he has retention.

June 24.—Filiform guide enters with difficulty, over which No. 17 electrode will not pass. Electrolysis had to be commenced again with a No. 9 French combination electrode, which passed strictures, and then two quarts of urine were drawn off.

During three seances July 5, 8, and 11, the caliber of the urethra had been enlarged to No. 17 French. Patient feels so well that he goes off again, this time to Bermuda.

1888.—Returns from Bermuda after one year's absence. Strictures have contracted, as was to be expected; this time only to No. 11.

June 12, 15 and 19.—In three seances of electrolysis the strictures were again enlarged to No. 17 French. A current from 4 to 5 milliampères was used, each seance lasting 8 to 10 minutes.

1889.—After another year's absence patient appears again. Strictures have contracted, only a little less than could be expected. From October 19 till November 4 four seances of electrolysis enlarged strictures to No. 21 French.

1890.—After the usual one year absence returns again. Has suffered much from rheumatic gout and strictures have contracted to No. 14 French.

October 18 and 31.—Has two electrolytic applications and disappears.

No case could present worse features than this: almost callous multiple strictures, so small that no stream would pass, impermeable to the passage of instruments, complicated with rheumatic gout. The electrolysis did its work, but the patient did not wait until he was cured, and during his absence gouty inflammations formed new impediments. This illustrates that strictures benefited, but not cured, may form again; but this new formation cannot be termed a relapse, or a failure.

MOOTED QUESTIONS.

In the diagnosis and treatment of strictures constitute an important factor in the subject under consideration. On many points teachers and authorities disagree, and consequently arrive at widely divergent conclusions. Some have adopted certain measurements as a basis for the calculation of the size of a normal urethra. Others contend that erectile tissues cannot be measured accurately, and that measures of the same individual at different times will give different results. There is a diversity of opinions as to the average size of a normal urethra, some placing it at a higher number of sounds than others, and this diversity varies according to the forms of the instrument upon which the calculations are expressed.

The following diagrams are made from measurements of instruments in actual use. The first two, figures, 9 and 10, represent the ordinary steel sounds, which are conical at the end, and the number is expressed by the size of the largest part of the stem, making a real difference of from 6 to 8 numbers in different parts of the instrument.

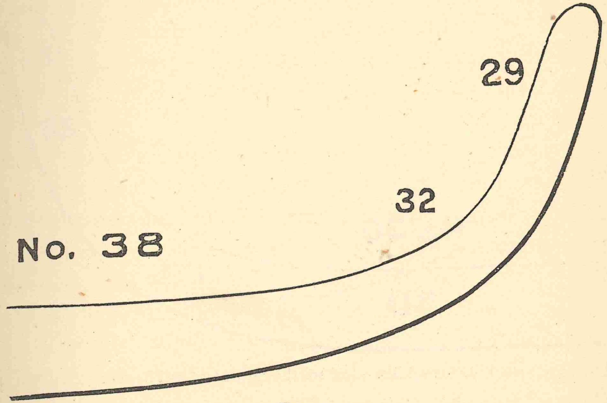

FIG. 9.

The latter two figures, 11 and 12, represent electrodes which have full size, as numbered at its bulb end. It will be seen at a glance that in the steel sounds a No. 38 is at its conical end only No. 24.;

this tapering end making a difference of four and nine numbers respectively.*

Therefore the No. 32 French electrode is, at its end, as large as the No. 40 steel sound. Hence, the diversity of opinion above referred to is in a great measure explained by these diagrams, especially in relation to the treatment by electrolysis.

There are differences of opinion on the question of what constitutes a stricture, its description and divisions. Some cannot recognize a spasmodic stricture, because a spasm is not a stricture, and the treatment for either must be different. In regard to treatment of strictures, also, the opinions are divided. Urethrotomy has been an acknowledged treatment, and its adherents condemn every other method, and are particularly opposed to electrolysis. The latter way of treatment, nevertheless, is an acknowledged success nowadays, and the following quotations will

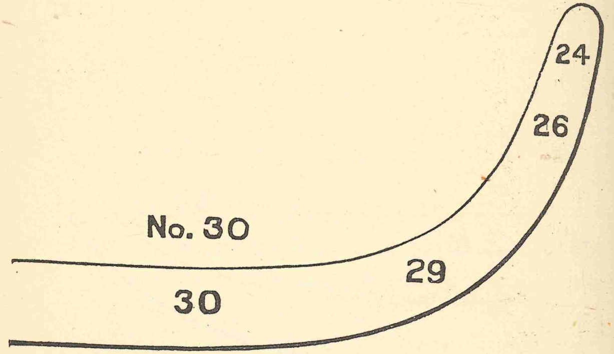

Fig. 10.—Figs. 9 and 10, the ordinary Steel Sound.

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* Figures 9, 10, 11, 12.

show it. Dr. John Harvey Girdner says in his article on "The Rational Treatment of Strictures of the Male Urethra":*

"From the standpoint of antisepsis, the operation of internal urethrotomy is a most glaring inconsistency, and a violation of the known laws of nature as applied to this part of the organism. You cannot cut a stricture internally without at the same time cutting some of the sound tissue in its neighborhood.

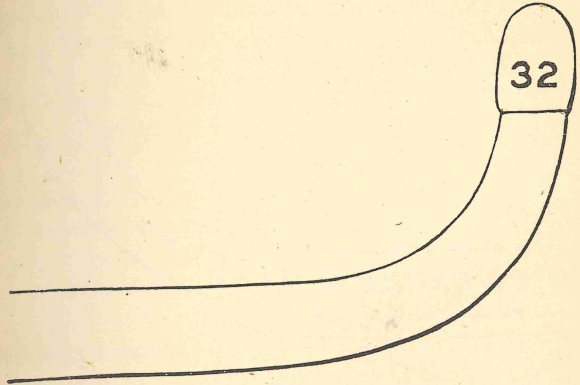

Fig. 11.

"Should the patient escape these dangers of infection, the worst is to follow, for, after this traumatism, nature adopts her old method of preserving the integrity of the urethra, and deposits more lymph at the seat of the stricture, and in the adjoining healthy tissue, which in time organizes and contracts, and not the old stricture, but a tighter one is formed, and the last state of that urethra is worse than the first."

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* *Medical News*, July 14, 1888, p. 39.

Another question is what constitutes *a cure* of stricture. Some insist that a cure must have restored to the urethra its so-called normal size, without regard to any future contraction, while others are satisfied when the urethra is so much enlarged that the patient is content, feels well, can pass a good stream, has no inconvenience, and does not wish any more improvement. In the latter case it does not matter what size the urethra attains if it only remains well without a relapse.

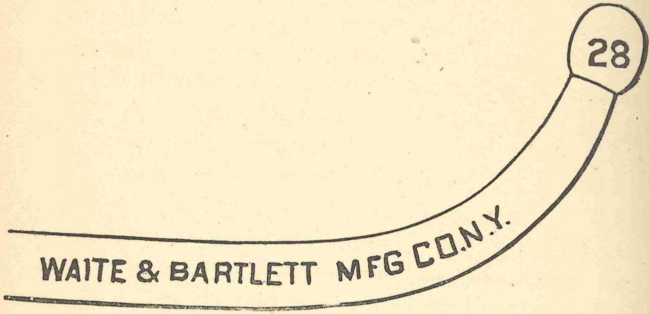

FIG. 12.—Figs. 11 and 12, Newman's Electrodes.

As long as such questions are not settled, there will be a disagreement among medical authorities, but the vital point is that the treatment must be called successful if the patient is well and content.

THE SUCCESS OF ELECTROLYSIS.

In the treatment of urethral stricture is well established by reports of thousands of cases, and acknowledged by all authors of modern works on electricity, and others.

I myself have practiced this method successfully for twenty years, and off and on have honestly reported cases which were complete for such purpose. Hundreds of cases could not be used for publication, because the cases were too incomplete; many having been seen only once in consultation, or operated on only once or a few times; many were lost sight of, and almost all of the charity cases in hospital and dispensary were unknown by name. The literature on the subject, and hosts of successful operators, are mentioned in an editorial of the *New England Medical Monthly*, December, 1887, which is worthy of perusal, and proves beyond peradventure the success of electrolysis in the treatment of urethral stricture. More evidence comes almost daily from honest workers who formerly were skeptics, or failed at first, and at last relate their successes. Among the latter, as an instance worthy of notice, the valuable article of F. Swinford Edwards, F.R.C.S., surgeon to the West London Hospital, and surgeon to the out-patients of St. Peter's Hospital for fistula, etc. (*Medical Press and Circular*, April 11, 1888), from which I take the liberty to quote:

"When, some two and a half years ago, the treatment of urethral stricture by electrolysis was taken up by my friends, Dr. Steavenson and Mr. Bruce Clarke, who were led to test its merits from the published reports of a brilliant series of cases by Dr. Newman, of New York, I determined to try it here at St. Peter's, and more especially in cases of resilient, or non-dilatable stricture, which in the usual course would be submitted to some cutting operation, attended possibly by risk of life, at all events necessitating detention in the hospital for one or more weeks, a loss of time which is of great moment to many, and most can ill afford. . . . . There is yet another reason why I have selected only the severer forms of stricture in which to test the capabilities of this method. It is in order that there should be no room for an objection which I heard raised. . . . . In the table of cases before you most of the strictures were of long duration, and were multiple.

"Now these strictures were no myths, nor was their resilient character open to doubt, some of them having been in the hospital under my colleagues, while others had been under the care of well-known hospital surgeons. The number of strictures, their caliber and distance from the meatus, has been noted and the result of treatment given, I trust, with impartiality. . . . . The first I treated with the aid of my friend, Dr. Steavenson, and so struck was I with the result obtained that I hastened to give electrolysis a fair trial at this hospital. The patient had been under me two and a half years previously with three strictures, which, after a month's treatment, I succeeded in dilating to No. 25. In February, 1886, he came to me again for stricture, but on this occasion I was unable to dilate the sub-pubic one by passing bougies. This then I conceived to be a good test case for the new treatment. For the result I have put down cured, as six months afterward, although he had undergone no treatment in the mean time, I found no sign of stricture after carefully examining his urethra."

I am well sustained in my report of several hundred cases by a record of numerous cases of an array of physicians from all parts of the world, among whom I

will mention, Drs. W. F. Hutchinson, T. F. Frank, David Prince, Jacob Butler, J. M. Glass, A. T. Douglass, D. O. Farrand, A. J. Wolff, J. B. Green, G. C. H. Meier, F. F. Dickman, R. J. Nunn, T. F. Sanders, J. Craft, A. J. Wolff, Jr., W. C. Wile, Benson, Edw. J. Smith, R. W. St. Clair, J. H. Kellogg, G. W. D. Patterson, T. H. Burchard, L. Wolf, J. J. Berry, W. T. Belfield, Geo. E. Pitzer, D. A. Bryce, G. W. Overall, Geo. H. Rohé, Earl, M. S. Tremain, A. A. Shuford, T. C. McCoy, A. P. Sampson, J. D. L. Davis, Hunne, E. S. Stephens, Booth, H. Graff, W. H. Walling, C. P. Thayer, Sutcliffe, Reynolds, Biedler, Dake, in the United States; next comes Canada with Drs. C. R. Dickson, J. J. Cassidy, A. Lapthorn Smith, and eminent surgeons in Great Britain; among them are particularly W. E. Steavenson, W. Bruce Clarke, Edwin Morton, J. T. Hayes, etc. Dr. Semeleder in Mexico, Dr. Leon Danion in Paris, Dr. H. Park in Shanghai. Two letters from Doctor Wile of Danbury and his patient, a physician, are reproduced here by permission.

DANBURY, CONN., November 24, 1888.

MY DEAR DOCTOR:

In reply to your conrteous note of November 24, I will state that I have seen cases successfully treated by you. Cases of stricture of the urethra which I have examined before and after treatment. I know organic stricture existed and that they were cured.

I have already treated about fifty cases myself, and all, except spasmodic stricture and those due to masturbation or of neurotic origin, have been either cured or so much relieved that all the objectionable symptoms have disappeared and the patient passed a full stream with no inconvenience whatever, and gave up the treatment of his own accord. This I consider one of the greatest drawbacks to electrolysis, that the treatment is so painless, and the relief so sudden, the patients consider themselves well before they are; consequently there is re-contraction, and the case is counted against the method by those who oppose it. Last Wednesday evening, before the Danbury Medical Society, I read a paper on this subject, and demonstrating its utility by operating upon a patient of Dr. Brown's of this city, passing with the galvanic current in fifteen minutes a No. 20 electrode, where three weeks before, when Dr. Brown first brought him to me, we could with the utmost difficulty pass a filiform bougie; thus demonstrating by test, that in four seances I had dilated painlessly from almost nothing to a No. 20 French.

The patient was a hack driver, and, according to his own history, given that evening before twenty or more physicians, he had never had a moment's pain or inconvenience, and had attended to his duties right straight along. I have on the table before me a letter from an eminent physician of Maryland, who came to me while in Philadelphia, for a stricture which proved to be two inches and one quarter long.

He is sixty-seven years old, and it took me seven seances with a No. 11 French tunneled electrode, threaded on a filiform bougie, to get through. This was the largest instrument that could be introduced at the time of my first seeing him. It took him three minutes and a quarter at that time to micturate. In reply to a letter from me he says:

"October 1, 1888.

"*Dear Doctor:* Your favor of — was received, and I was glad to hear from you. I have been thinking of writing to you for several months, but have been so on the go that I neglected it. I have been gone most of the time since early summer, and arrived home a few weeks ago from an extended tour through Canada, the White Mountains, etc. I think (thanks to your skillful treatment) I am perfectly well of the stricture. Have not used the battery for four months; but pass No. 30 electrode every six weeks, without the slighest trouble, and without meeting with the least resistance anywhere in the urethral canal. If I did not know from previous experience, I could not tell in what part of the canal the stricture had been located. The stream is round and full; all irritability of the bladder is gone; and what is best of all, I have not had an attack of the gout since the first seance, which is now over fifteen months; having never had over four months to elapse without an attack, previous to the electrolysis, for the last three years. Of course, I cannot say positively that the removal of the stricture, which was hard and dense, and had existed since 1860, is the reason that I have been exempt from the gout; but I firmly believe it. My feet are not now tender at all, and I can wear shoes as tight as I could in my boyish days. I have not been traveling for my health at all; but for pleasure and the gratification of my better half. I never used more than seven cells; and, after twice using seven, never went beyond five. The last time I introduced the No. 30 electrode, which was a week ago, nine weeks had elapsed since its previous introduction, owing to being away; but I did not encounter the slightest trouble, pain, or inconvenience on its introduction, and did it as quickly as you could introduce an ordinary catheter into a perfectly normal urethra. Of course I mean I did it without using the battery at all. When you consider how dense and hard and long-standing the stricture was (over twenty-six years), and how the smallest electrode could not be passed, and even found it difficult to pass a filiform bougie, I think the results have been simply marvelous. And no matter what is said or who disputes the efficacy of electrolysis in urethral strictures, I will swear by it every time; for facts are stubborn things that cannot be ignored, and have been proved beyond the shadow of a doubt, under my own observation, and in my own person. I am satisfied that, to accomplish the best results from electrolysis in urethral stricture, the seances ought not to be very close together. I should say two weeks, unless circumstances were such that the patient could not be gotten at at pleasure."

It will be seen that I withhold the gentleman's name, but the case can be vouched for by Prof. Shoemaker, of Philadelphia.

W. C. WILE, M.D.

The following letter from Dr. J. B. Greene of Mishawaka will also prove, that after a cure by electrolysis no relapse took place, and that the urethra was restored to a normal state, which was ascertained at the post mortem.

MISHAWAKA, IND., March 17, 1890.

MY DEAR DOCTOR:

I write you for the purpose of informing you of the permanency of cure of urethral stricture by electrolysis. In 1884 I treated Mr. Henry C., of this country for an old or rather a series of old urethral (gonorrhœal) strictures. The first bulb passed was No. 12 French; when I discharged him (within the next three months) a No. 19 French steel would easily enter the bladder. I heard no more of any urethral difficulty, and attended him during his last illness in October and November, 1889. He died in November. After death, in the presence of Dr. R. T. Van Pelt of this place, and Dr. C. M. Butterworth and A. L. Wagner of South Bend, Ind., I made a post mortem. I particularly called the attention of the gentlemen to the condition the urethra had been in, and they, one and all, after thorough and careful examination, declared the urethra perfectly healthy, and the prostate normal, neither indurated nor hypertrophied, which is remarkable in a man seventy-two or seventy-three years of age. I know there was a prostatic enlargement when I first examined the case, and I think its normal appearance, post mortem, was the result of the cure of the stricture.

Case 2 was one of a traumatic stricture, result of a kick in the perineum in 1885. When he applied for treatment, he had suffered for a number of years; he passed urine drop by drop with great difficulty. I inserted a filiform bougie, found a stricture of fully two inches in deep perineum. Succeeded introducing a No. 6 French, which I made myself, insulating the staff with gum shellac, from that to 8, 10, 12, and run to 18, with intervals of not less than ten days nor over fourteen between seances. I saw no more of the case after the No. 18 introduction until last month, nearly five years. I examined him thoroughly, and found no sign of the stricture. He takes a No. 18 French steel readily, and of its own weight. His name is H. A. P., Jackson, Mich. I am curing more cases of chronic gonorrhœa with your prostatic cautery sound than I ever expected to cure by any means. Again thanking you for your valuable investigation, and hoping, etc., etc.,

Very truly yours,

J. B. GREENE.

Dr. W. F. Hutchinson, of Providence, an acknowledged authority in electricity, says, in his excellent work, recently published ("Practical Electro-Therapeutics," p. 219), as follows:

"Looking over my list of operations, several hundred in number, I see but two that need special description. These two are for urethral stricture and uterine fibroids. The galvanic operation for the former was devised at about the same time by Dr. Robert Newman and myself, and fully tabulated by Dr. N., who has had large dispensary experience with it, as well as a great a number of private cases. Dr. Newman deserves a pioneer's laurels in this new path.

"The entire operation, which rarely exceeds seven minutes in length, is effective and leaves the patient as ready to attend to his daily affairs the moment it is over, and thenceforward, as he was before, and which would have supplanted the frequently unsatisfactory surgery of urethral stricture long ago if surgeons clearly understood its performance and appreciated its results."

This practical work on electricity, recently published by Records, McMullin & Co., in Philadelphia, is strongly recommended to the general practitioner.

Dr. Hutchinson also writes in private letters:

October 15, 1888.

I operated to-day, with complete success, where one of our best surgeons had failed, using his battery and electrodes. He was completely set back, anticipating my defeat as well as his own. How about Brown's artificial urethra? but it seems to me that we are doing pretty well. Yours, etc.

October 22, 1888.

Have just had a good bit of news. A patient, German, rich, etc., was brought to me eighteen months ago, with two difficult fibroid strictures,—admitting No. 5, French—of ten years' standing. One operation was all that was made, and I saw him to-day for the first time well, happy, and admitting No. 27 French, freely. Dr. Anthony, the Secretary of the Rhode Island Medical Society, brought the patient, and will certify.

Faithfully yours, etc.

Dr. W. E. Steavenson, whose authority as an electrician in London is acknowledged, and whose successes are recorded, writes also to me, in private letters, from which I cite as follows:

39 WELBECK STREET, LONDON, December 6, 1886.

I can quite indorse that you say about the causes of failure in the electrolysis of strictures. I do not believe it can ever become the universal method of treatment by all practitioners, although no doubt the best; but medical men will never take the necessary trouble; they have not the patience and perseverance, and the operation, without care, may fail from so many different causes. I have never had the least hesitation in referring to you as an authority on the permanency of the cure, for every one of your countrymen (and that is not a few), who have visited my electrical department at St. Bartholomew's Hospital, have assured me that any statement made by you may be implicitly relied upon.

September 30, 1888.

DEAR DR. NEWMAN: I am glad to see by the (September 8) number of the *American Medical Journal* that you have answered the very weak criticism of Dr. Thomas. I had almost thought of writing an answer myself, but it is much better answered by you. I wrote a long paper on the treatment of stricture of the urethra by electrolysis, in the July number of the *Provincial Medical Journal*, published at Leicester, in this country. In referring to my cases of stricture of the urethra, I find that a large number of patients cease to attend, and are satisfied when the caliber of their urethra is enlarged to No. 22 French, which corresponds to about No. 12 on the English scale. It is impossible to keep either private or hospital patients on as long as one would wish.

I remain, etc.

Remarks of Dr. C. S. Wood, at the meeting of the Northwestern Medical and Surgical Society of New York, April 18, 1888 (*The Medical Record*, June 16, 1888, p. 674):

"Dr. Wood was pleased with the favorable consideration given to this subject after the years of criticism and vituperation which had been heaped upon it, especially in this city. Regarding the question of cauterization, he recalled a former meeting held in his own house, where Dr. Newman had demonstrated the effect of the current, using cartilage covered with mucous membrane. The cartilage had been dissolved and returned to its original elements, while the mucous membrane had been uninjured. He recalled a case which he had referred to Dr. Newman for treatment. The patient was fifty years of age, the bladder emptied by drops, and a filiform bougie was entered with difficulty. The patient had suffered with chills, and had been disqualified for business for several months. After eight weeks' treatment he was entirely cured, and has had no difficulty since. The speaker had recently referred the question of recurrence to Drs. Bangs and McBurney, at the St. Luke's Hospital. He had asked whether, after division of stricture at one point, there was permanent cure. They had replied that the sound must be passed occasionally for a year, or even during life in some cases. The permanency of the cure by electrolysis was thus in its favor. Electrolysis destroyed the whole of the ring, while internal urethrotomy destroyed it in but one place."

Dr. J. J. Berry, Portsmouth, N. H., has recently reported more successful cases (*Southern Medical Record*, p. 250), and, in a letter to me, concluded:

September 13, 1888.

If the process of electrolysis is effective in even one case, it occurs, to a greater or less extent, in all; and I then attribute any partial failure in one of those cases to lack of technical skill and experience rather than to the method itself. Wishing you continued successes, I am, etc.

From a letter of Dr. R. W. St. Clair, Brooklyn, N. Y.:

April 10, 1888.

Dear Doctor: For the last five years I have been a follower of yours. I was one of the first to believe in and take up your treatment of urethral stricture. I have read everything from your pen, with the greatest care, and have treated some one hundred patients, for stricture, by electrolysis. I have had the best results, and whenever I write up a case I always give the credit where it belongs, and that is to Robert Newman, etc.

From the eminent leader of the great Sanitarium of Battle Creek, Mich., Dr. J. H. Kellog. He writes, in a letter:

February 9, 1888.

Dear Doctor: Please accept thanks for your two valuable papers, just received. I have made use of your method in the treatment of stricture, with good results, and am anxious to try the cautery method in treating a large prostate, etc.

These quotations are given to show how universally the method of electrolysis in the treatment of urethral strictures has been adopted and successfully practiced. There is more on file in abundance. There are also witnesses and documentary evidences for everything stated therein.

New York, 68 West Fifty Sixth Street.

ROBERT NEWMAN, M. D.
68 WEST 36TH STREET,
NEW YORK.

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156 Madison Avenue, New York, March 29, 1886.

Waite & Bartlett:

Dear Sirs: I cheerfully testify to the convenience, durability and general excellence of your electrical apparatus designed for medical purposes.

Your reputation as expert practical electricians in telephonic and telegraphic work has been fully sustained in this new department of electrical manufacture. The mechanical work which you have performed under my guidance has been eminently satisfactory to me.

Respectfully yours, A. L. RANNEY, M.D.,
Prof. of Anatomy and Physiology of the Nervous System in the N. Y. Post-Grad. Medical School and Hospital;
Prof. of Nervous and Mental Diseases in the Med. Dept. of the University of Vermont.

---

43 West 54th St., New York, April 28, 1886.

I have used for nearly a year one of Waite & Bartlett's Statical Electrical Machines, and find it to be entirely satisfactory in every respect. It keeps its charge in all kinds of weather, and gives a large and intense spark.

WILLIAM A. HAMMOND, M.D.

---

20 West 45th St., New York, April 30, 1889.

It gives me pleasure to certify that I have used the Waite & Bartlett Cabinet (Leclanchè cells) almost daily for the last four years, and that it has given me perfect satisfaction. All my electrical apparatus have been made for me by Waite & Bartlett during the last ten years.

PAUL F. MUNDÉ, M.D.

---

158 Montague St., Brooklyn, N. Y., April 28, 1886.

It gives me pleasure to say that the electrical devices of your make which have been in use at the New York Polyclinic, have given me entire satisfaction. Yours very truly,

LANDON CARTER GRAY.

New York, April 25, 1886.

I take pleasure in stating that after examination of various batteries, I chose your "Perfected Cabinet" for use in this Hospital, and am entirely satisfied with the same.

Very respectfully,
WALTER WYMAN, M.D.,
Surgeon in charge U. S. Marine Hospital, New York.

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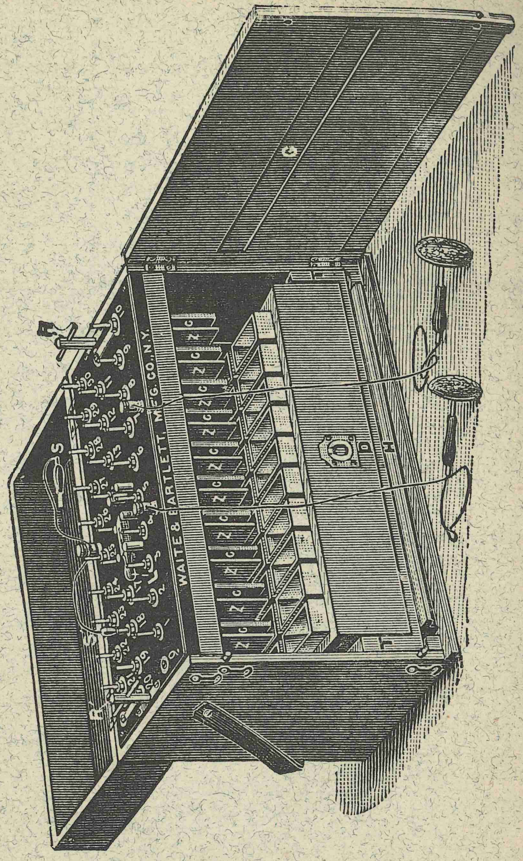
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THE ELECTROTHERAPEUTIC CONTROL OF CURRENTS FROM CENTRAL STATIONS.

BY

GEORGE W. JACOBY, M.D.

REPRINTED FROM THE
New York Medical Journal
for December 3 and 10, 1898.

6 Celled.

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THE
ELECTROTHERAPEUTIC CONTROL OF CURRENTS FROM CENTRAL STATIONS.*

BY GEORGE W. JACOBY, M. D.

THE history of electrotherapeutics is worthy of study, and is of unusual interest in showing to what vicissitudes a single branch of medicine may be subject, and how, with all advantages in its favor, it has from time to time fallen into disrepute and furnished the ground for gross abuse and the most rampant quackery.

The history of electrotherapy may be said to start with the invention of the friction machine by von Guericke in 1663; for more than a century thereafter static electricity alone was employed. The end of the eighteenth century, bringing with it, as it did, the discoveries of Galvani and Volta, relegated to obscurity the applications of static electricity with their inordinately vaunted cures.

The galvanic current in its turn, on account of the impractical apparatus which at that time was necessary

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* Read before the Metropolitan Medical Society, September 27, 1898.

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for its production, was not long able to maintain its position. It was really not until Oersted discovered the force of magneto-electricity, and a few years later Faraday made his fundamental discovery of induced electricity, that, in consequence of the construction of the first induction coil, electrotherapy escaped from the contumely with which it had to a greater or less extent been regarded.

In 1881, at the International Congress in Paris, another impetus, one which may be looked upon as the turning point in its scientific career, was given to electrotherapy. This was the adoption of standards of measurement, and with them the introduction of the absolute galvanometer.

In consequence of this and of much other scientific work, electrotherapy then constituted a science *per se*, which by many was considered unassailable. Soon thereafter, as a result of perfected apparatus, came the rejuvenation of static electricity in Paris. Its employment there, chiefly upon hysterical patients, coincided in point of time with the renewed attention bestowed upon hypnotism. The instantaneous results obtained upon this class of patients with both of these measures could not fail to attract attention, and from this to the assumption that both agents acted through the same means—namely, suggestion—was but one step. Added to the intense enthusiasm displayed by electrotherapists the world over, was a dense ignorance on their part of the physical laws governing the flow of electricity and of its physiological effects. It may therefore be easily understood why observers scientifically schooled were thus ready recipients for the sweeping assertions which soon followed.

These assertions were those of Möbius, that our knowledge of the curative *action* of electricity is *nil*, and that at least four fifths of the curative *effects* of electricity are of psychic character, due to suggestion.

It is by no means the object of this paper to enter upon the question of the physiological effects of electricity or of its therapeutic value, but we wish to emphasize at this place that only he will attain any positive knowledge in either of these directions who is the possessor of a complete understanding of the physics of electricity, and of proper apparatus to accurately measure and control the current of which he makes use. During the past decade the study of electricity has received fresh impetus through the various uses to which it has been put by commercial enterprise, and its medical application, together with the construction of new apparatus for this purpose, has accordingly benefited.

At no time in the previous history of electrotherapy has the physician been in so enviable a position as he is to-day. Upon the one hand he possesses accurate measuring instruments—the milliampèremeter, the voltmeter, the coulombmeter—so that his studies may be correspondingly scientific in character; upon the other hand, he has at his command sources of electrical supply which leave nothing to be desired. From the lamp which serves to light his office he receives an unfailing supply of electrical energy. Here he has primarily all that the uniform flow from the galvanic cell can give him.

By means of an intercalated coil he obtains that form of dissymmetrical alternating current which is familiar to all of us as the medical induction apparatus. He is able to charge his storage cells, to light an exploring lamp, by means of a motor to drive his static machine, or to work his therapeutic alternator; from this apparatus he can in turn obtain the current known as sinusoidal, and can by means of proper arrangement absolutely control the rapidity, the electromotor force, and even the shape of its E. M. F. curve. He can obtain the current necessary to satisfactorily feed his X-ray apparatus; and, finally, he can by the use of the required condenser and solenoid obtain those currents of great frequency and high potential whose phenomena, to make use of Hedley's language, "are a revelation to the scientific mind, and whose physiological effects open out new fields of physiological research, and point to endless therapeutic possibilities."

Compare for one moment this picture with that of a few years ago, when our batteries gave us infinite trouble and an infinitesimal current; when a special source of current was necessary for galvanism, faradaism, light, power, and cautery; when the amount of current applied was guessed at by the number of cells used, and when the application of electricity was accomplished only through the medium of wet and dirty sponges or, *horribile dictu*, by means of two metal cylinders, one of which the patient grasped in each hand.

While the actual purpose of this paper is to acquaint you with the means which I make use of to regulate and control the current as delivered by commercial enterprise into our houses, and which to me presents the only absolute solution of the difficulties encountered, I so thoroughly feel that the application for medical purposes of currents supplied by central stations is understood by but very few, that I hope you will pardon me if, in the endeavor to make matters clear, I may say certain things

which are familiar to some of you, and possibly also others which are known to you all. Allow me, therefore, to assume that you have forgotten what you know, and to begin with first principles.

As Singer and Berens understandingly put it, electricity is neither an agency nor a cause, but a *result* of certain conditions; the conditions being unequal states of excitation, and the "electricity" being merely inferred as present whenever the equalization of two such bodies in unequal states is intercepted by a third body, which thereby undergoes some modification. This modification is always the indicator of the supposed "electric current," and may consist in increase of temperature, chemical changes, magnetism, or mechanical motion. The phenomena of electricity then being due to the equalization of bodies in different states of excitation, the body in a high state of excitation will be positive to a body of lower excitation, negative to a body in a still higher state of excitation, and indifferent to a body in an equal state of excitation.

It is this difference in the degree of excitability of two metals which is known as "difference of potential." And the higher potential in a constant or galvanic current is known as the positive pole, the lower potential as the negative pole.

While all forms of electricity are identical, inasmuch as they are all due to the equalization of bodies in different states of excitation, yet the manner of excitation of the bodies will produce differences in the "currents" obtained, so that these again may differ in their physiological and therapeutic effect.

Until now electro-medicine has made use of three forms of current: the galvanic, faradaic, and static.

These are now supplemented by (1) the pulsatory currents produced by the electromotor force of the ordinary constant-current dynamo; (2) alternating currents of a more or less perfectly sinusoidal character, the frequency of which may vary from a few to thousands of alternations in a second.

The ordinary alternating electric-light currents are of this nature, with a frequency of about seven thousand to ten thousand alternations a minute.

The "wave symbol" is used as a convenient means of expressing graphically one of the differences between currents, and the instrument known as the electrograph is used to register these waves. The differences in the "wave type" of E. M. F. thus give rise to the following forms of currents (Houston and Kennelly):

1. Continuous currents.

(*a*) Steady. { Produced by a uniform electromotive force, such as that of a Leclanché cell.

(*b*) Pulsatory. { Continuous and unidirectional, but not of uniform strength.
Such a current is produced by the constant-current dynamo.

These pulsatory currents again are subdivided into intermittent and non-intermittent.

2. Alternating currents—*i. e.*, currents which periodically reverse their direction.

(*a*) Symmetrical. { Sinusoidal.
Non-sinusoidal.

(*b*) Dissymmetrical.

A third form, which has been mentioned and which is now used in electrotherapy, is constituted by the currents of high frequency and high potential, whose alternations may vary from hundreds of thousands to a billion to the second.

The currents from the constant-current dynamo are continuous currents, which constantly flow in the same direction, but, inasmuch as they are pulsatory, are not absolutely uniform in strength. In so far they differ in their physical nature from the current produced by a uniformly acting battery, as the Leclanché.

In these constant-current dynamos, the currents which arise in the wires of the armature of the dynamo, as it passes the magnetic poles, and which necessarily, since they alternately pass in front of the positive and negative poles, are of alternating nature, are changed by means of commutators into currents of one direction; in alternating dynamos this commutator is absent, and they produce currents of constantly changing direction, like the faradaic currents.

The positive and negative maxima are equal, but are not smoothly attained, so that their graphic representation is not wavy in nature, but more or less angular.

The alternating current of a sinusoidal type, on the other hand, is a current, taking its name from the law of sines, which gradually attains its positive and negative maximum, is of gradually varying strength, and shows no actual interruptions.

Graphically it is represented by a curve of sines, which is in marked contrast to the angular representation of a coil's alternations.

Currents of high frequency and potential are most easily obtained for medical purposes by means of the oscillating Leyden-jar discharges traversing a solenoid.

For an understanding of the physics of electricity it is necessary to resolve the "current" into its components.

In every electric current, no matter what its source, two main factors must be thoroughly understood—namely, pressure and volume. A battery or other source of energy establishes a difference in the state of excitation between two bodies, or, what is equivalent, a difference of electric pressure between two points. This difference in pressure is called electromotor force, and its unit of measure is the volt.

The volt represents the E. M. F. necessary to make a quantity of electricity equivalent to one coulomb pass in one second when the resistance of the circuit is one ohm (a Daniell cell is equal to 1.124 volts); therefore the volt is the measure of pressure or tension of the current. We can understand this clearly by a few comparisons.

Thus, in a reservoir of water, the pressure with which the water is forced into the supply pipes leading therefrom would be the analogue of the electromotor force (pressure) produced by a battery; or, in a gas-lighting plant, with a low pressure in the reservoir, the flames at the ends of the channels supplied by gas would hardly be kept alive, but as the pressure is increased more gas would be forced through the opening and the flames become larger; or, in the case of a boiler in which a difference in tension (pressure) exists on both sides of the shell, it is evident that the greater this difference of pressure outside and inside the shell, the greater the amount of steam that will flow through a pipe of a given size and length.

In the same manner, the greater the difference in pressure between the two terminals of a battery, the

greater the current which will flow through a wire of a given size and length.

Therefore it is a law that the current which will flow through a conductor will be proportional to the difference in pressure or electromotor force between its terminals.

The volume of current is the amount of electricity pushed through a conductor by the pressure behind it; or, in the cases of the water reservoir, gas plant, and steam boiler, the amount will in each case depend not only upon the pressure, but also upon the size of the openings of the pipes and upon the amount of friction thus encountered—*i. e.*, the length of the pipes. In the same manner, when a current of electricity flows from a point of high pressure to one of low pressure, through a path provided therefor, and this path is a wire, this wire will furnish an opposition to the flow of current in proportion to its calibre and length. It is this opposition which in electrical science is known as resistance. In the case of the water, gas, or steam, the resistance which the pipe furnishes to the escape of either of them from their container will vary with the length of the pipe and inversely with its size. This is true of the wire which connects the two points of unequal pressure of the battery; the longer it is and the thinner it is the greater will be the resistance and the less current will flow.

Hence it is a law that the resistance of a conductor (aside from its specific resistance—*i. e.*, the substance of which it is made) is dependent upon the length and diameter of the conductor, and is directly proportionate to its length and inversely proportionate to its diameter $\left(R=\frac{L}{D}\right)$, and that the current which will flow through a conductor will be inversely proportionate to its resistance.

The unit of measurement for resistance (R) is the ohm. Its value is equal to the resistance which is offered to the passage of a current by a column of mercury one millimetre square and a hundred and six centimetres in length at a temperature of melting ice.

We are now in a position to return to the second main component of a current—namely, its volume or quantity or strength. The ampère is the measure for the strength of the current, and indirectly thus also for its quantity or volume. In physics the actual measure for quantity is the coulomb. A coulomb is the quantity of electricity present when one ampère strength flows one second; or the coulomb represents the quantity of electricity necessary to electrolytically set free 0.010384 milligramme of hydrogen from water.

The coulomb may be entirely neglected and the ampère alone used, if we consider the time in which a certain number of ampères flow. We then speak of ampère hours, an ampère hour being one ampère flowing for thirty-six hundred seconds. Therefore one ampère is equal to thirty-six hundred coulombs, or a current has one ampère strength when it gives out one coulomb per second.

With these facts in mind we may also use the ampère, which really is only a measure of strength, as a measure of quantity, and then an ampère is the volume of current which a pressure of one volt will push through a resistance of one ohm, one ampère $= \frac{1 \text{ volt}}{1 \text{ ohm}}$.

In medicine we make use of $\frac{1}{1000}$ ampère, milliampère, equal to $\frac{1 \text{ volt}}{1000 \text{ ohms}}$.

The volume of current, we have seen, is dependent upon the pressure (E. M. F.) and the resistance (R). And it is so dependent in the manner expressed by Ohm's law: The current in a closed galvanic circuit is directly proportionate to the electromotor force and inversely proportionate to the resistance in the circuit, or $C = \frac{E}{R}$

Or this may be written in its equivalents, $E = C \times R$, or $R = \frac{E}{C}$

If, therefore, we have a wire the resistance of which is one ohm and at the terminals of which there is a difference in pressure (E. M. F.) of one volt, then, according to the above law, one ampère of current will flow through the wire, and it will be clear that we can increase or decrease this current either by increasing or decreasing the E, or by decreasing or increasing the R. This increase or decrease of the current practically means its control.

The use of cells as a source of supply of electrical energy is so familiar to all physicians that I may fittingly begin my remarks concerning the practical control of electricity by reference to this source.

Much is to be said against the employment of batteries for the production of electricity; such batteries have all in all been exceedingly annoying and unsatisfactory, especially when used with a low resistance in the circuit, as for electrolysis, light, and galvano-cautery, in which cases the cells become quickly exhausted, and the expense of replenishment is not an inconsiderable one; apart from the expense, however, the time and trouble necessary to their proper care and refilling, as occasion demands, are very great, and sorely try the patience of the busy physician. At the same time, while these remarks apply fully to batteries of older make, they must be used only with a certain amount of reserve as regards cells of modern construction. Such modern cells are closed on top, almost hermetically, and the amount of evaporation which takes place has been reduced to a minimum. They, when properly cared for, kept in a dry place, may remain useful for from one to three years, according to the amount of service required from them; if, however, the cells are placed in a damp location (as in a cellar), trouble soon occurs, electrolytic action being set up by the escape of current through the damp air, and the connections thus becoming attacked are quickly corroded. All the objections to the use of cells have been recognized for many years, and attempts have been repeatedly made to overcome them; inasmuch as the current derived from dynamo machines seemed to fulfill all the requirements demanded of the battery current, the idea of substituting the former for the latter lay very near; when, furthermore, physicians began to recognize that for all technical purposes the dynamo machines had, on account of the superior satisfaction which they gave, almost entirely supplanted batteries as a source of current supply, the question of the same applicability in medicine urgently obtruded itself. At present the majority of physicians who employ electricity still rely upon batteries as a source of supply, either because they have no access to a dynamo current, or because, on account of the unsatisfactory controlling apparatus obtainable, they have found its use impracticable.

Those physicians belonging to the latter category will be relieved from their embarrassment by the subsequent descriptions; the others will still have to rely upon the use of cells, and for them we make the following remarks concerning the methods of use of current from primary batteries.

Without again going over all the arguments which have been advanced for many years by ourselves and others, it may be fairly stated that the Leclanché battery is of all the most durable and the most economical.

The pressure (E. M. F.) of such a single cell is one volt and a half; at the terminals of this cell about two ampères of current are obtainable, and according to Ohm's law its inner resistance will be $R = \frac{E}{C}$, or $R = \frac{1.5}{2} = 0.75$ ohm.

In the application of galvanism to the human body we must take into consideration the poor conductivity, *i. e.*, the high resistance, of the tissues treated, and for that reason, in order to obtain sufficient pressure to drive the desired current through this large interposed resistance, we must increase the number of cells to be used. A battery of, say, fifty cells would give us a pressure of $1\frac{1}{2} \times 50 = 75$ volts, with an internal resistance of $0.75 \times 50 = 37.5$ ohms.

In order to apply the current from such a source, a current regulator is absolutely essential. It is hardly necessary to speak at this late day of the need of a galvanometer, nor of the disadvantages of cell selectors, for the use of the former has become quite generally replaced by the employment of a variable resistance (rheostat). Yet the method of making use of the entire available current, and regulating it by means of a rheostat, has one very grave objection, and that is that the intensity of the entire battery accompanies even the smallest amount of current applied, and thus materially increases the pain accompanying the application. This objection can, however, be readily obviated, for there can no longer be any doubt that the increase of pain with an increase of the current is dependent upon *how* the resistance is placed in circuit. There certainly is a difference between applying, say, ten milliampères of current at a pressure of seventy-five volts through a resistance placed in series with the patient and applying the same number of milliampères with the resistance so placed that the pressure is reduced to the amount just sufficient to overcome the resistance of that part of the patient's body which is being treated.

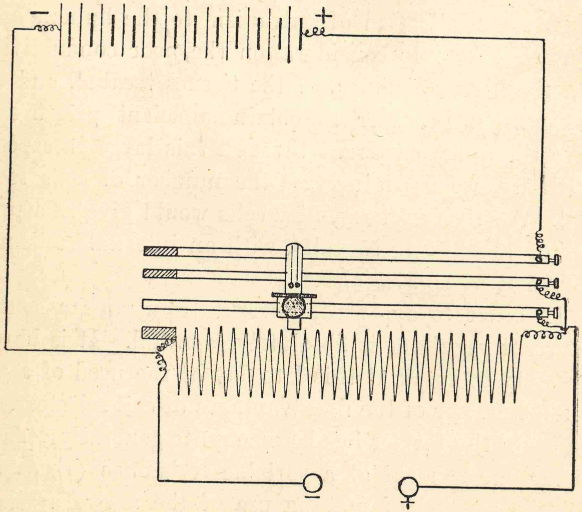

FIG. 1.

The accompanying sketch illustrates the manner in which this regulating resistance should be employed.

The regulation is here effected by means of the well-known shunt principle. This principle, the law governing the division of current in a compound closed circuit, should be thoroughly understood. If a current can flow through several paths, as when, for instance, the poles of a battery are connected to several wires, the current will divide itself, according to a law of Kirchhof (mathematically demonstrable, but upon whose demonstration we can not enter here), so that the strength of each branch current is directly proportional to the resistance of this branch circuit. Or, to express this in another manner, the conductor, which is joined to a main conductor, carries current in proportion to the relation which its own conductivity bears to the conductivity of the main one. Thus, if the conductivity of the main conductor is two, that of the second conductor eight, the joint conductivity will be ten. Ten parts of current will flow through both conductors, two

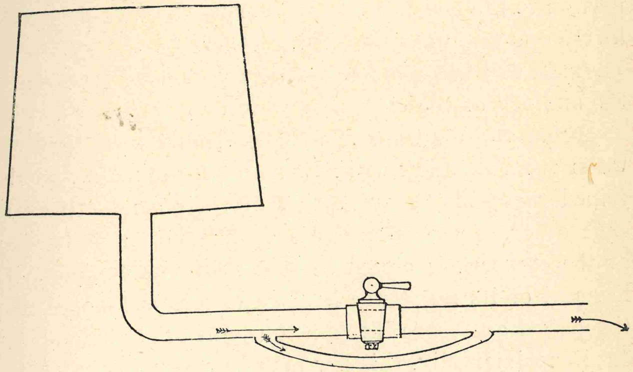

FIG. 2.

through the main, and eight through the secondary (shunt) conductor. It will also be clear that if the conductivity of one of these conductors is varied, the current flowing through each of them will be varied in proportion to the resistance thus interposed—*i. e.*, decreased in the one and increased in the other.

This will become clear if we again have recourse to the analogy of the cistern of water.

From the diagram it will be readily seen that the water from the tank will flow through the main and the joined pipes in the proportion of their conductivity to each other, if the stopcock is open; and in proportion as the stopcock is closed in the main (its conductivity lessened or its resistance increased) less water will flow through it and more through the joint or shunt.

Experimentally, this law may be easily demonstrated to apply to a current of electricity in the following manner: Let B (Fig. 3) represent the battery, whose flow of current is limited to about a hundred milliampères, and from which a divided conductor carries the current over D to the rheostat R and to the human body R_1. A galvanometer is included in each of the divided currents B D R E and B D R_1 E. If the resistance in R is made to equal that of R_1 the galvanometers will indicate that the currents in both circuits are equal. Assuming the equal resistance to be 3,000 ohms, then, if we increase the resistance in R to 4,000, 5,000, etc., the galvanometers will indicate that the currents in R and R_1 have become as 3 : 4, 3 : 5, etc.; or if we diminish the resistance in R to 1,000, 500, etc., the currents will have become as 3 : 1, 3 : 0.5, etc.

If, finally, we introduce another galvanometer into the unbranched circuit B D E, it will be found that the current here is equal to the sum of the current strengths in the branches.

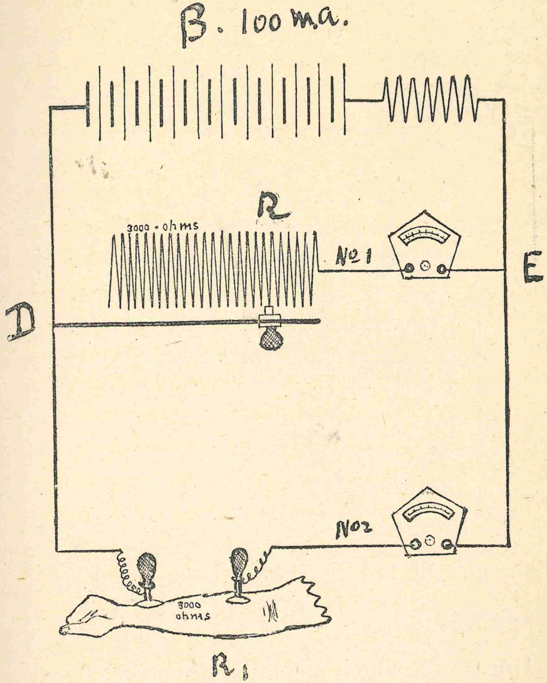

FIG. 3.

These principles, practically applied, are shown in Fig. 4.

B is a battery from which the current flows from + to R (resistance); a certain amount of this current is forced through this resistance and passes to –, and thus completes the circuit.

This amount of current is wasted, and therefore it is well to make the resistance as large as practicable in proportion to the pressure obtained, thereby minimizing the loss of current.

If, for instance, our battery represents an E. M. F. of forty volts and we introduce into the main circuit

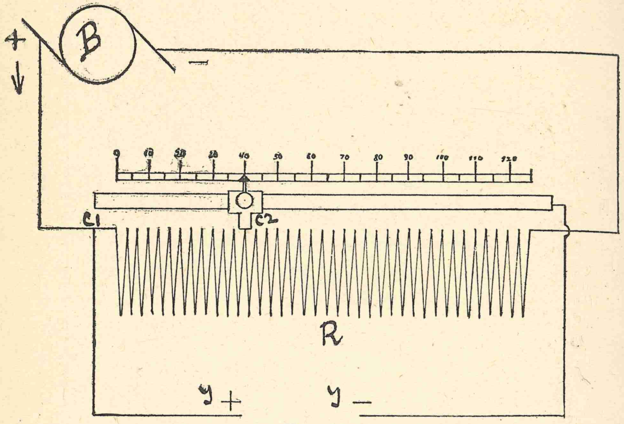

FIG. 4.

a resistance of ten thousand ohms, the current forced through this resistance will be $C = \frac{\text{E. M. F.}}{\text{R.}}$, $\frac{40}{10000} =$ 0.004 ampères, which amount represents the actual loss of current. By a shunt we now derive our therapeutic current: One conductor is attached at a point C_1 and the other to a bar, which carries a slide contact C_2, and which is electrically connected to this bar.

As the flow of current through a shunt is directly proportionate to the resistance in the main, no current will be obtained at T + and T − when the slide contact C_2 is nearest to C_1—that is, if there is no resistance to speak of between C_2 and C_1; as soon, however, as we

move the slide C_2 away from C_1, and thus introduce resistance, a current will be obtained at T +, T −, whose intensity will increase until all the resistance has been intercalated between C_1 and C_2.

We have as yet said nothing concerning the reduction of pressure (E. M. F.), which was the real consideration from which we started in speaking of shunt currents. If in a circuit the R remains constant, we know that the current will vary directly with the E. M. F. For instance, if the resistance of a wire be two ohms and the E. M. F. at its terminal two volts, one ampère of current will flow. If the voltage be doubled (four volts) the current also will be doubled. Now, if the current passing through a conductor remains constant, we see from the formula $\text{E. M. F.} = C \times R$ that the E. M. F. between any two points in the conductor will be directly proportionate to the R of the conductor between these two points.

To return to our assumed battery of forty volts pressure with a resistance of ten thousand ohms in the main circuit, and assuming, furthermore, that the resistance is made up of a cylindrical body, the total or highest resistance of which lies between its terminals E and O (Fig. 5), and that this resistance is evenly distributed along the surface of the cylinder.

Then a voltmeter whose terminals are brought into contact with the surface of said cylinder will indicate an intensity of current which is in direct proportion to the length of the part of the cylinder which lies between these terminals. Thus, if one fourth of the entire cylinder is connected between the terminals of the voltmeter, the meter will indicate one fourth of the initial voltage. If, now, a scale be affixed to the resistance coil, a scale which has been properly graded so that each division corresponds to one volt, then the voltage may be read directly from this scale without the use of the voltmeter. But, inasmuch as we are also introducing resistance directly into the circuit, not only the voltage but also the current itself will be thus reduced. The resistance outside of the shunt contact must be considered as an analogue of the internal resistance of a battery; if, therefore, we attach one end of the conductor of a shunt circuit to thirty and the other to ten, we will have a current in the shunt of twenty volts E. M. F., one half of forty, the proportion which the resistance between the terminals bears to the entire rheostat of the cylinder, with an ampèrage of $7\frac{9}{10}$ milliampères.

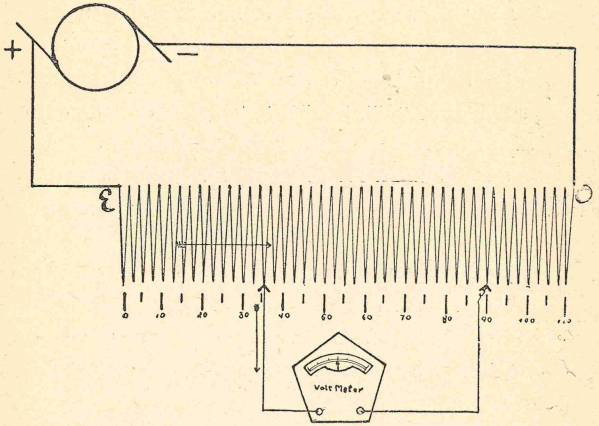

FIG. 5.

The ampèrage is calculated as follows: Resistance on cylinder outside of the shunt terminals, $2 \times \frac{1}{4}$ of $10{,}000 = 5{,}000$ ohms, which must be looked upon as

the inner resistance of the battery and added to the actual inner resistance, 37.5 ohms.

Then $C = \dfrac{40}{37.5+5{,}000} = 7\frac{9}{10}$ milliampères.

The resistance between ten and thirty is, of course, also 5,000 ohms, but, as it has been short-circuited, it has been practically eliminated.

The mechanical arrangement of controlling apparatus for the battery current can easily be deduced from the above remarks; and in describing the controllers for the electric-light current it will again become necessary to refer to them.

Dynamo Currents.—At first impression it seems foolhardy to desire to make use of an electric current for medical purposes which has caused so many accidents; the convenience of this source of current is, however, so great that if it can be shown that the dynamo currents can be so regulated that their employment is unattended with danger, then every physician who has access to such a current will undoubtedly make use of it.

The current which is easiest to use is the one employed for lighting incandescent lamps, as that one is furnished directly in all modern houses.

For lighting lamps both direct and alternating currents are used. The direct-current dynamos deliver a current which to all intents and purposes is constant,* and which practically in no way differs from a battery current. It will serve the purposes of the physician in every way.

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* Ample experiments have been made which prove that nothing need be feared on account of the inconstancy of the current, as is shown by the steadiness of the galvanometer needle.

The alternating current, on the other hand, is wanting in electrolytic quality, and requires a transformer for cutting down the voltage and a commutator for turning the alternating current into a unidirectional one before it can be made available for our purposes.

In New York city the direct current delivered to us is the Edison current, which we receive at a pressure of a hundred and ten volts approximately. It is this current to which we refer in the following, unless some other is specially mentioned. In considering the physical laws governing this current all that has been said concerning battery currents will apply here, only that, inasmuch as we have no internal resistance to deal with, we can from our one-hundred-and-ten-volt source of supply obtain an infinitely large current if an infinitely small resistance is placed in the current, and it need hardly be said that by interposing a sufficiently large resistance we can prevent any current whatever from passing.

We therefore see that practically the regulation of our current is entirely a question of interposed resistance.

Before now proceeding with a description of the apparatus used for control of the current pressure and current quantity let us directly answer the question which is daily asked: Is there no danger in the use of an electric-light current? *There certainly is!* But the danger in New York and other large cities, with their subways and perfected source of supply, does not lie, as is generally assumed, in the sudden increase of the current strength or in the failure of supply. The actual dangers against which we must guard lie, as Hedley has shown, in *leakage currents*, and, when the alternating current is employed, also in the breakdown of insulation between primary and secondary transformers.

The first source of danger has by all writers, with the exception of Hedley, been underestimated or completely ignored; nevertheless, the danger is a menacing one and may give rise to serious accidents. In order to understand these accidents let us see how the direct current is distributed to the consumer here in New York. This is done by the three-wire system.

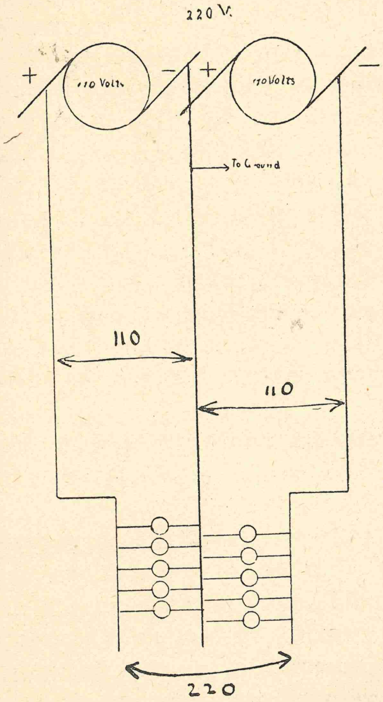

FIG. 6.

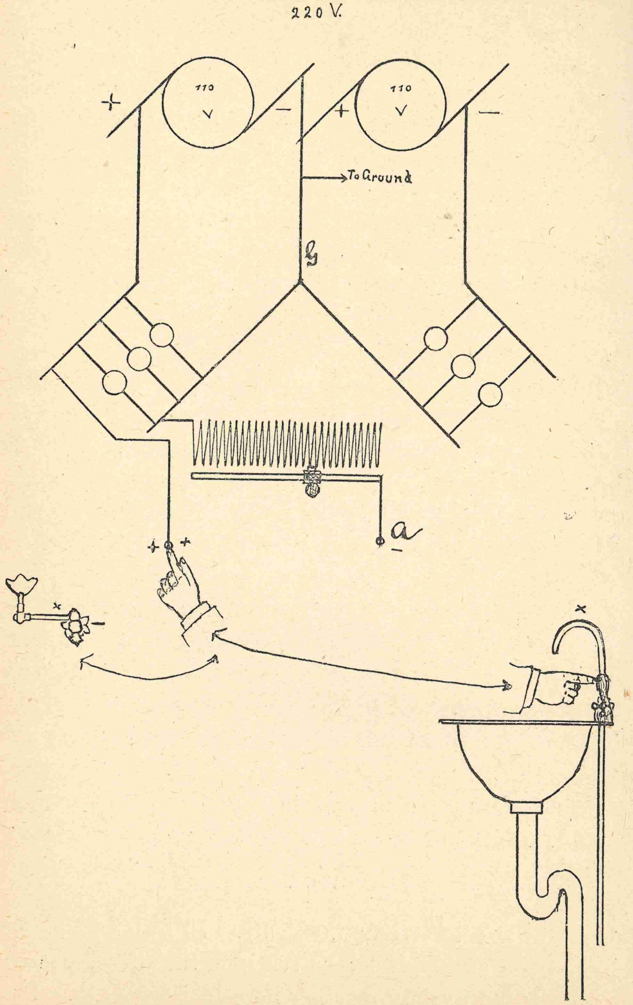

Fig. 7.

This system consists of a double circuit, each one of which has an E. M. F. of a hundred and ten volts, the entire circuit thus giving two hundred and twenty. This is done for purely practical purposes, inasmuch as two hundred and twenty volts will carry a larger amount of current a longer distance with a smaller percentage of loss than a hundred and ten volts will.

In this double circuit the middle or neutral wire leads to the ground, or is perhaps, contrary to law, even grounded.

The accompanying diagram shows the wiring of such a two-hundred-and-twenty-volt circuit.

Inasmuch as all water and gas pipes are under ground, the neutral or grounded wire may prove a source of danger by carrying an excessive amount of current into houses through these gas and water pipes, as they actually form branches of the neutral wire which are free in the rooms at all outlets—*i. e.*, gas jets, chandeliers, bath tubs, and faucets.

This danger is shown in the following diagram.

It will here be seen that the neutral wire *g* is connected through the earth to faucets and gas arms, and certainly also to waste pipes. Now, if the rheostat or current-regulating device is connected between the one terminal *a*, leading to the patient, and the wire *g*, in the diagram, then we can plainly see that if the patient should in any way form a ground connection, through a damp floor or through a bath tub with a waste pipe attached, or by coming in contact with a gas arm or water faucet, the rheostat would become useless, as the current would take the course of least resistance and pass from the ground through the patient to the positive wire, thus giving the patient the full voltage (one hundred and ten) on the line.

It is thus apparent that there is danger connected with the use of the street currents, unless the right wires are first selected and the proper controlling apparatus thus placed in the proper place. The proper manner of introducing the controlling apparatus is shown in Figs. 8 and 8*a*.

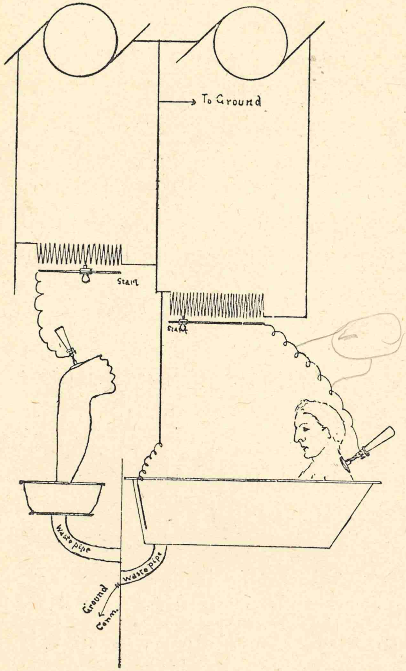

FIG. 8, 8a.

As previously mentioned, another source of danger may lie in a sudden increase of current on the line in consequence of an accident at the central station, or through the crossing of our supply wires by wires from another source (arc lights); while this is not liable to occur in New York city, a method should be provided to guard against danger from such an occurrence.

This danger may be practically overcome by the employment of a compound shunt. Here the shunted current is again shunted and the already reduced voltage again reduced. No more delicate graduation of a current can be imagined than the one obtainable by this means. A reference to Fig. 9 will make this clear.

I believe that this is the first time that this idea has been practically applied.

We are now in a position to use any current at our disposal for any purpose which may be necessary.

It is all a question of the proper device for controlling the current for the purpose in question, and of placing this device at the proper location in the current.

The device for controlling the direct current from the main will differ from that necessary to control the battery current only in its adaptation to the larger volume of current which we make use of. The principles governing such adaptation are as follows:

1. In galvanization of the human body no more than one ampère of current is ever required; therefore an additional resistance sufficient to limit the volume to this amount may be placed and *allowed to remain* in series with the controlling device.

This is the limit resistance and is non-variable.

As such a limit resistance incandescent lamps have been used, such lamps limiting the current in accordance with their candle power; thus with a one-hundred-and-ten-volt current an eight-candle-power lamp would limit the current to a fourth ampère; a sixteen-candle-power lamp would limit the current to half an ampère; a thirty-two-candle-power lamp would limit the current to one ampère; a fifty-candle-power lamp would limit the cur-

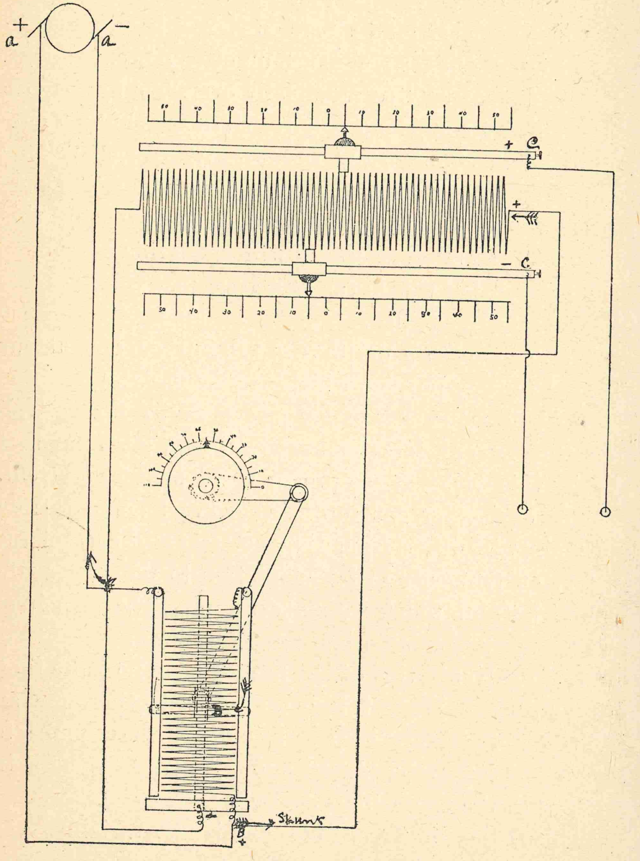

Fig. 9.

rent to one ampère and a half; but these limits are only correct when the lamps are at full incandescence, as the carbon filaments have a great deal higher resistance when below incandescence. On the other hand, the life of the lamp is limited, and the filament is apt to break, or may become detached from its socket, even before it is exhausted, by a sudden jar, and thus the supply of current be suddenly cut off.

A wire resistance of the proper capacity has very many advantages: it always furnishes a reliable and unvariable resistance, will not deteriorate, and if properly arranged will not get out of order.

Secondly, we must make use of some contrivance for regulating the intensity and the quantity of the current thus obtained.

In almost all contrivances now in use, together with a galvanic controller (rheostat), lamps are employed for shunting off current—that is, for reducing the voltage or intensity. Nothing can be more reprehensible than such an arrangement, for, should such a shunt lamp break down or loosen from its socket, the voltage of the current passing through the patient would be suddenly and very materially augmented.

2. For affecting the relative intensities of a current, a rheostat (of considerably higher resistance) is connected in series with the limit resistance, and from this rheostat we derive our current, properly modified and perfectly adjustable.

In the construction of these rheostats for the use of the street current we must not fail to consider that a greater amount of heat is apt to be generated in the resistance cylinders than would be the case if the battery current were used.

This heat production must, if possible, be guarded against, not only because it may be so great as to fuse the wires, and thus destroy the apparatus, but also because the resistance in the controlling device will vary with the temperature and thus interfere with accurate measurements. This is the main reason, so it seems to me, why carbon rheostats are more or less unsatisfactory when used in connection with the street current. I have made use of such rheostats for years, with entire satisfaction with a battery current, and with entire dissatisfaction with a street current.

The only satisfactory rheostat for use in connection with the street current is a metal resistance device of the proper capacity, with *sufficient heat radiating surface.**

The apparatus which I make use of for regulation of the current (voltage and ampèrage) from the main

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* Heating capacity: One hundred and ten volts will send half an ampère through two hundred and twenty ohms; if this resistance is made to consist of a thin wire of about four feet in length, it would at once become red hot when connected with a one-hundred-and-ten-volt circuit; if the wire were made longer, it would necessarily have to be made thicker in order to keep its resistance at two hundred and twenty ohms; then, while the same amount of heat would actually be generated in the wire, it would nevertheless not become so hot as in the case of the thinner wire, because it presents a larger amount of surface to the surrounding atmosphere and thus permits of the escape of more heat. Therefore, the greater the amount of heat-radiating surface, the less heat will there be throughout the entire resistance. If, however, we take the thicker wire and, instead of connecting it to a one-hundred-and-ten-volt circuit, connect it with one of two hundred and twenty volts, we would again have the same state of affairs. It is thus apparent that our resistance must, in addition to having ample heat-radiating surface, also be adjusted in accordance with the pressure of the available source, and the resistance body selected must be of sufficient capacity to carry the limit of current required for the special purpose.

therefore consists of the following: A limit resistance made in accordance with the foregoing principles. A resistance cylinder in the main circuit (first volt controller shown in Fig. 10) from which a current is shunted; this shunt current is passed through another controller (second volt controller of Fig. 10), and herefrom another current is derived, in the circuit of which the patient is placed.

The current in the shunt circuit will always be proportionate to the resistance of the main and that of the shunt circuit. In the resistance in the main (first volt controller) two terminals or slide contacts are employed for the purpose of varying the relative resistances, according to their position upon the cylinder. If the terminals are at opposite ends of the resistance cylinder, the entire resistance in the main is interposed, and the maximum amount of current obtainable will flow through the shunt circuit. As the contacts are approached to each other, the interposed resistance in the main grows less and the current in the shunt becomes correspondingly diminished, until they are directly opposite each other on the cylinder, when no current will flow in the shunt. The electromotive force in the shunt current will also be dependent upon the resistance in the main as already elucidated.

E. M. F. of main, 110 volts.

Resistance of cylinder, 1,100 ohms.

If now we include twenty-five ohms between the two slide contacts, according to the laws which have been explained, the E. M. F. in the closed shunt will be $\frac{110 \times 25}{1100} = 2.5$ volts; or, if we take five hundred ohms between the slides, we will obtain E. M. F. $\frac{110 \times 500}{1100} = 50$ volts.

Owing to the construction of the resistance cylinder, the variations in the intensity of the shunt current take place very gradually by small fractions of a volt.

The shunt current thus selected is then still further reduced by the second controller, which is constructed similarly to controller No. 1, only that it is so modified that no switch is required to turn the current on and off. The same movement (hand or motor power) that actuates the slide contacts turns the current on and off by means of two bars and a spring which traverses them. These circuit-breaking bars run parallel with one of the slide bars, and each one forms a continuous conductor from one end of the resistance cylinder to the other; but at that point at which the two slide contacts are directly opposite each other, the spring which has formed an electrical connection between the two bars is forced to ride into an insulation, thus breaking the electrical contact between the two circuit-breaking bars; then no current will pass through the controller.

The current in the shunt can not be shut off without gradually diminishing it to zero.

This apparatus thus embodies in itself the rheostat, the pole changer, the circuit-closing switch, the slow interrupter, and a sinusoidal machine of slow alternations.

For other purposes than the direct application of the current to the human body slight alterations must be made according to the purpose designed, thus:

For all purposes of minor importance it is economy to use incandescent lamps as ampère limits; as, for instance, for operating the faradaic coil, for lighting small exploring and examining lamps, and for charging storage batteries.

Exploring Lamps.—Take between a quarter and an ampère and a half current and from four to fifteen volts. The circuit for such lamp would consist of a fifty-candle-power lamp, which allows an ampère and a half to pass, and a volt controller in series with the lamp.

The controller, having a capacity of an ampère and a half, need not have a resistance of more than twenty ohms; the voltage then obtainable would be—

E. M. F., a hundred and ten volts.

Resistance of lamp, seventy-three ohms.

Resistance of shunt (controller), twenty ohms.

$$\frac{110 \times 20}{73 + 20} = 23.6 \text{ volts.}$$

Thus 23.6 volts can be obtained at a strength of nearly one ampère and a half, and the current can be varied by fractions of a volt. The small lamps in use require between four and fifteen volts.

Faradaic Current.—In order not to burn the platinum contact plate on the interrupter of the ordinary faradaic coil, it is necessary to reduce the tension of the current to one similar to that obtained from two to three cells—*i. e.*, four to six volts.

For the excitation of a faradaic coil, the same kind of a rheostat can be used, but it is unnecessary to limit to an ampère and a half and to go as high as twenty-three volts. In fact, all that would be required for operating the coil would be a lamp of thirty-two candle power in series with a four- to six-ohm resistance wire of one ampère capacity; that would make it equal to a three- to four-cell battery, because a shunt or parallel connection with six ohms carrying one ampère yields about six volts at one ampère—*i. e.*, $\frac{110 \times 6}{110 + 6} = 5.6$ volts.

This could be still further regulated if desirable.

Cautery.—In order to heat the metal of the instruments placed in circuit for cautery purposes we must get our current, if we use batteries, from cells of high E. M. F. and very low internal resistance. That a current of this nature, one giving fifteen to twenty ampères, is easiest obtained from the line and not from batteries is evident.

Accordingly, various devices have been constructed for the purpose of utilizing directly the current from the main. Among the first of these was a rheostat of twenty ampères capacity. Here, however, in order to have the use of a hundred and twenty watts of energy, two thousand and eighty had to be wasted, and an enormous amount of heat was generated in the rheostat in a very short space of time.

This appliance proved in every way to be more inconvenient than a storage battery, as a shunt current had to be obtained of an intensity of about ten volts; a higher voltage would cause heating of the contacts, of cautery handle, and arc at the break of the current.

The use of a motor-dynamo seems to offer a better source of current for cautery work.

This apparatus may be called a rotary transformer, and consists of a machine of one common field and two windings on one armature, each winding having its proper commutator.

The one-hundred-and-ten-volt current is connected to the fine wire winding as motive power, and is returned in a transformed state, fit to heat cautery electrodes and snares.

Or the one-hundred-and-ten-volt direct current may

be utilized for cautery purposes by placing collector rings upon the armature shaft and connecting them to opposite segments of the commutator; from these collector rings an alternating current is obtained which is of nearly the same intensity as the current from the main, but is easily transformed by means of a proper step-down transformer.

It is, however, my conviction that these outfits as today placed upon the market are mere toys. For efficient work a motor of less than one quarter horse power is entirely out of the question.

I believe that a good storage battery is more reliable and more economical for cautery work than any of the above appliances. The method of wiring the apparatus which I make use of for electrotherapeutic work, and which consists of the two controllers, a motor and motor controller, a milliampèremeter, a voltmeter, a high-tension coil, and an appliance for lighting small exploring lamps, is shown in Fig. 10. All forms of current (galvanic, faradaic, galvano-faradaic, galvanic interrupted, and sinusoidal), except that for illuminating purposes, are obtained directly through the three binding posts on the front of the apparatus.

In conclusion, I would make a few remarks concerning another source of danger in the use of the street current.

The danger is one which can, of course, occur only with transformed systems, and is that due to a breakdown on the insulation between the primary and secondary windings of a transformer.

In such an occurrence the secondary windings would have their potential very materially raised.

This is an occurrence which can not be guarded against, so the only remedy could lie in some arrangement by which the current would be cut off in the event of such an occurrence.

Various apparatus for this purpose exist: one by means of which the secondary mains are automatically connected to the earth upon a dangerous rise in potential; another means would be to have a second transformer in circuit with the patient, or, finally, to make use of a magnetic cut-out in the circuit so that upon rise in pressure of the current the cut-out will gradually diminish the current to zero. Fusible cut-outs and lamps as safeguards are worse than useless, for they induce us to place confidence in apparatus which will never act promptly, as they require time to melt or to break. But even the safety cut-offs first spoken of, no matter how well constructed, must fail to guard the patient against a momentary shock, which, no matter how short in duration, may, for all we know to the contrary, do irreparable damage.

No safety cut-out can act before the increased current has reached it, and as soon as it has done this, it has also passed over it to the other end of the line.

The only absolute safety in the use of transformed systems lies in the employment of storage batteries.

NOTE.—The apparatus above described has been made for me by the Wappler Electric Controller Company of this city, and I am indebted to Mr. R. Wappler for the drawings of the diagrams as well as for much other valuable assistance in the preparation of this article. The cell selector constructed by Dr. Rudisch and myself in 1883 furnished the starting point for the elaboration of the principles incorporated here.

Literature.

1. Broese, P. Ueber die Verwendbarkeit der von Dynamomaschinen erzeugten Electricität zu medicini-

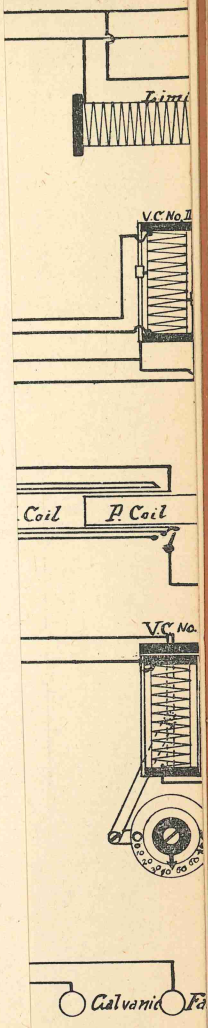

FIG. 10.

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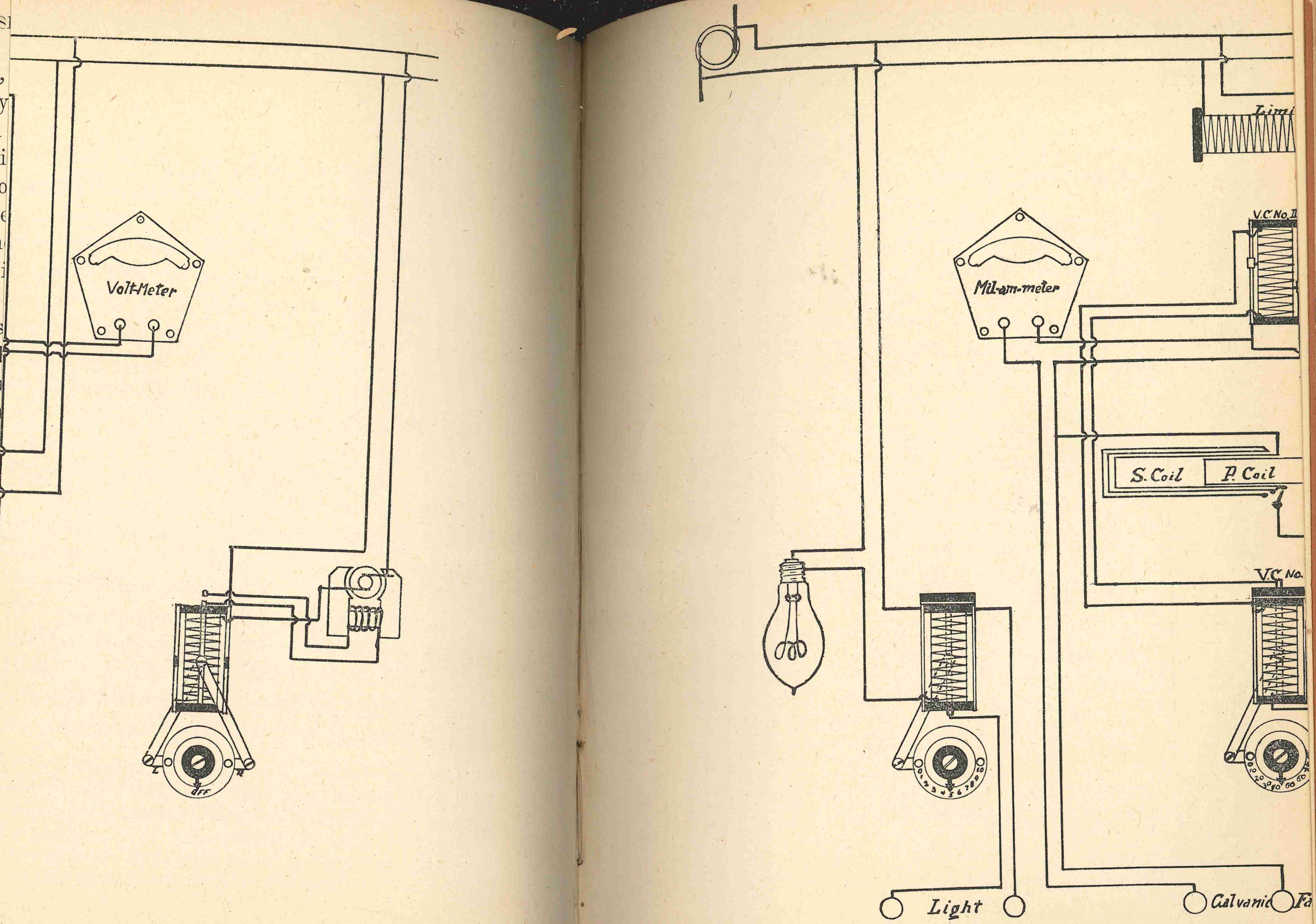
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FIG. 10.

schen Zwecken. *Berliner klinische Wochenschrift,* p. 935, 1890.

2. Hedley, W. S. *Lancet,* i, p. 1108, 1895.
3. Hedley, W. S. *Lancet,* i, p. 1279, 1896.
4. Hedley, W. S. *Current from the Main.* London: H. K. Lewis, 1896.
5. Houston and Kennelley. *Electricity in Therapeutics.* W. J. Johnston & Co., New York, 1896.
6. Rudisch, J., and Jacoby, George W. Galvanic Batteries in Medicine, etc. *Journal of Nervous and Mental Disease,* January, 1894.
7. Singer and Berens. *Some Unrecognized Laws of Nature.* New York: D. Appleton and Company, 1897.

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A Farther Study of Anodal Diffusion as a Therapeutic Agent

BY

FREDERICK PETERSON, M.D.

ATTENDING PHYSICIAN TO THE NEW YORK HOSPITAL FOR NERVOUS DISEASES

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IN a paper read before the Section on Theory and Practice of the New York Academy of Medicine, in February, 1889, I called attention to the therapeutic value of the cataphoretic power of electricity, to which power I gave the name anodal diffusion.[2] The ability of a galvanic current, in flowing from the positive to the negative pole, to seemingly carry substances with it even through a membrane, or through the skin, has been affirmed by some, but even to this day, denied by other authorities.

Dr. B. W. Richardson first drew attention to what he termed voltaic narcotism in two articles in the *Medical Times and Gazette*, in 1859. He produced local anæsthesia with solutions of morphia, aconite, and chloroform, but the storm of opposition aroused over Europe made him subsequently abandon what was an actual discovery.

---

[1] Read before the Northwestern Medical and Surgical Society of New York, December 17, 1890.

[2] New York Medical Journal, April 27, 1889.

H. Munk killed rabbits by placing a solution of strychnia upon the anode, and applying it to the skin of the animals for a few minutes with moderate currents. Quinine and potassium iodide had also, many years ago, been experimentally introduced by cataphoresis, and quickly detected in the urine.[1]

Nothing further was published until 1886, when Wagner[2] printed a short note expressing a belief that anæsthesia might be produced by the use of cocaine on the anode. He made no experiments.

In the same year Adamkiewicz[3] introduced his diffusion electrode and described his experiments and successes with chloroform in the production of anæsthesia and the relief of pain.

The conclusions of Adamkiewicz were attacked by Paschkis and Wagner,[4] who claimed that the contact of the chloroform with the skin was sufficient to produce the anæsthesia, and that the galvanic current had nothing to do with it for the resistance of chloroform was so great that it could not conduct at all.

Lumbroso and Matteini[5] employed chloroform the same year with ordinary electrodes for the relief of neuralgia.

Dr. Corning,[6] of this city, produced anæsthesia with a five per cent. solution of cocaine on the anode after pricking the skin with needles. This was also in 1886.

Dr. Reynolds,[7] of Chicago, published, in 1887, an article upon the use of cocaine in two to twenty per cent-solutions with the anode in his dermatological practice for small cutaneous operations and for the electrolysis of hair roots. He also used voltaic narcotism in one case

of tooth-extraction, as had been done by Richardson just thirty years before. Owing to the publication of Dr. Reynolds's paper in the journal mentioned, it escaped my notice altogether, and was not included in the list of authorities given in my first paper. I am under obligation to Dr. R. H. M. Dawbarn for kindly calling my attention to it. Although Wagner and Corning had separately written about cocaine cataphoresis before Reynolds, they had not given it as great practical application as the latter.

When I took up the subject of anodal diffusion in the winter of 1888 and 1889, the bulk of information at my command was limited and uncertain. There was so much controversy on every point, so much diversity of opinion, that even the existence of the cataphoretic power of electricity seemed to be as yet not scientifically proven. I therefore made some hundred experiments upon myself and patients, the most important of which were detailed in my first paper already referred to.

The results of previous experiments may be summed up as follows:

The current alone does not produce anæsthesia at either pole, although the anode has a transitory soothing effect over painful foci.

A watery solution of cocaine applied to the skin is not absorbed, does not produce anæsthesia, except, perhaps, after an indefinitely long period. The same is true of chloroform and of an alcoholic solution of aconitia.

A watery solution of cocaine is diffused through the skin and subcutaneous tissues by the anode, but not by the cathode. This is true of chloroform, aconitia, strychnia, potassium iodide, corrosive sublimate, tincture of iodine, and other medicaments.

The anæsthesia produced by a ten to twenty per cent. solution of cocaine on the anode is sufficient for small operations and affords distinct relief for from four to eleven hours in cases of severe neuralgias in superficial nerves and without constitutional effects.

---

[1] Landois and Sterling's Physiology, page 489.

[2] Wien. Med. Presse, 1886, page 212.

[3] Neurolog. Centralb., vol. v., pp. 219–497.

[4] Ibid., vol. v., page 413.

[5] Sulla cataforesi elettrica. La riforma medica, July and November, 1886.

[6] New York Medical Journal, November 6, 1886.

[7] Journal of the American Medical Association, August 20, 1887.

The Adamkiewicz electrode is absolutely worthless, since it is so stupidly constructed that the current does not pass through the fluid contained within it but through its circular metallic rim.

Chloroform, recommended by Adamkiewicz, and by Lumbroso, and Matteini, should only be used for cataphoretic purposes when, in addition to producing a local anæsthesia it is desired to counter-irritate, for it causes a disagreeable dermatitis of a week's duration, as I have had reason to learn by experiment upon myself. It does induce a deep analgesia beneath the anode, but it also vesicates.

Up to February, 1889, I had employed anodal diffusion of solutions of cocaine and aconitia, separately or mingled, in two severe cases of chronic supra-orbital neuralgia, selected for me as crucial tests by Dr. Seguin; in one case of double trigeminal neuralgia; in one case of inferior maxillary neuralgia; in one case of locomotor ataxia for the relief of dorsal neuralgic pains. The success of the measure in all of these cases was undisputed. It gave hours of relief from excruciating pain, and without constitutional effects of any kind. Nothing was claimed for it as a curative procedure, but it certainly proved to be a more than efficient substitute in these cases for morphine, which, as we too well know, is so prone to exact for its hours of solace lifetimes of wreck and ruin.

Since the publication of my paper other articles which serve to show the growing recognition of the value of the method have emanated from various sources. Dr. Cagney,[1] of London, reported his experience in the use of cataphoresis before the Harveian Society, November 7, 1889. He employed iodine and a saturated solution of potassium iodide with the anode for labyrinthine deafness, lead palsy, small tumors of the skin and mucous membranes; for syphilitic and other throat affections; for chronic pharyngitis; for nodes and gummata, tubercular ulcers, mucous patches and papular syphilides; for indolent ulcers, lupus, acute and strumous glands. In the discussion upon Dr. Cagney's paper, Mr. Juler stated that he had found the method useful in tobacco amblyopia.

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[1] British Medical Journal, November 16, 1889.

In the same month, Drs. Gärtner and Ehrmann[1] made a communication to the Imperial-Royal Society of Physicians, of Vienna, in reference to the cataphoretic use of corrosive sublimate. Dr. Gärtner's electric bath-tub was employed, from four to six grammes of mercuric bichloride being dissolved in the water of the bath. A current strength of 100 milliampères was passed through the person experimented upon for fifteen or twenty minutes, and subsequently mercury was found in the urine in as large a quantity as 1.3 milligr. There were traces of the metal in the urine for from four to six days after the bath.

Some time ago Boccolari and Manzieri[2] announced their intention to study the effects of electric cataphoresis in connection with mineral baths, but I have been able to find no published record of the results of their studies in this direction. They have published, however, their use of anodal diffusion of drugs in parasitic affections of hair roots.

Woodbury[3] described in May, 1890, his successful employment of the anode with a solution of iodide of lithium in a case with a syphilitic cutaneous neoplasm.

Shoemaker[4] has also written upon the uses of cataphoresis in certain skin diseases.

Dr. A. Barth[5] describes cocaine cataphoresis as employed by him in a number of operations upon the tympanum and external auditory meatus, finding a ten per cent. solution on cotton connected with the anode very successful.

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[1] Wiener Med. Blätter, November 28, 1889.

[2] Internat. Klin. Rundschau, September 2, 1888.

[3] Philadelphia Medical News, June 21, 1890.

[4] Sajous' Annual, 1890.

[5] New York Archives of Otology, April–July, 1890, New York, pp. 100–101.

At the International Congress held at Berlin in August, 1890, Dr. Bayles, of Orange, N. J., read a communication from Mr. Edison, the inventor, upon the medical employment of cataphoresis. The transactions of the Congress not yet having been published, I am indebted to my friend, Mr. A. E. Kennelly, Chief Electrician of the Edison Laboratory, for the following brief synopsis of Mr. Edison's experiments :

"The first trials were purely physical. With a current of twenty milliampères, lithium chloride was forced through a septum of animal membrane by electrical endosmose.

"The second series of trials was upon the person of a healthy young laborer, who dipped one hand in a solution of common salt, and the other in a five per cent. solution of lithium chloride in water, for two hours daily for ten days. His urine examined before the test showed no more than mere traces of lithium. His urine collected during that period exhibited distinct presence of lithium—five milliampères.

"The third trial was upon the person of an old man suffering from acute and chronic uric-acid concretions. He was in an advanced stage of the ailment, and most of his joints were affected ; the joints between the phalanges were almost obliterated. He immersed one hand in lithium chloride solution, the other in common salt solution, while a current from the one hundred and twenty volt electric-light circuit was employed through resistance to pass through his body. Measurements of the hand in the lithium chloride solution showed after some twenty-five hours of total application, a distinct reduction of bulk. There was also considerable relief from pain, and the general condition of the patient was ameliorated. The current strength in his case was twenty millliampères (four times more than the previous healthy subject could stand with convenience)."

Mr. Kennelly also calls my attention to a pretty experiment recently described by Dr. Ehrmann to demonstrate the cataphoretic power of the anode :

Take two similar glass vessels, with zinc electrodes at the bottom, and filled with a very weak solution of methyl blue. Insert the hands, one in each, and cause ten to twenty milliampères to pass for five to ten minutes. The hand in the anode vessel will be covered with blue spots.

The earlier criticisms of medical men that there was no such thing as the anodal diffusion of drugs must in the face of such accumulating evidence be entirely silenced. It is only one and a half years ago since, in the discussion of my paper, some who took part manifested entire incredulity. The far more vital criticism, however, that accuracy of dosage was impossible by this method of medication has been until now unanswered. The hollow electrode of Munk with clay bottom, of Adamkiewicz with carbon bottom, and of myself with a membranous bottom, each has failed to determine properly the quantity of the medicament employed. But this is now no longer a valid argument against anodal diffusion, since by the means I have of late employed, exact dosage is simplicity itself.[1] It is only essential to possess a flat metal electrode, preferably but not necessarily of platinum (platinum is now almost as costly as gold) or tin. A nickel plated surface will answer. This may be made of any size, round or square, convex or concave. A piece of tissue or filtering paper or linen is cut to fit over the metal surface. Upon it is placed, drop by drop, the solution of any drug to be used, and the electrode is then applied to the skin. There is then a thin capillary layer of the medicament in the paper disk between the electrode and the skin, and the quantity of the drug is known. The electrode made for me by Messrs. White & Bartlett, of this city, is round, flat, two or three centimetres in diameter, and is provided with a narrow, soft rubber rim at its edge, which, by its close approximation to the skin, prevents any loss of the solution by evaporation. In order to have drugs ready for use at any time, disks of paper to fit the electrode may be charged with aqueous or alcoholic solutions, and then allowed to dry, a drop or two of menstruum being added when they are to be used. Otto Boeddiker, Pharmacist, 954 Sixth Avenue, of this city, is prepared to furnish anyone with medicated cataphoretic disks to fit the electrode, and has made for me satisfactory disks of menthol, cocaine, helleborin, strychnine, iodol, corrosive sublimate, aconitine, potassium iodide, imidosuccinate of mercury, and the chloride and benzoate of lithium.

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[1] New York Medical Journal, November 15, 1890.

As regards the current strength to be employed one must be guided by the patient's feelings. Anywhere from five to twenty milliampères may be used for from five to fifteen minutes. The stronger the current the shorter the duration of the *séance*. If one has no galvanometer he may use ten to thirty or more cells of any battery, Grenet, Lèclanchè, or chloride of silver.

Anodal Diffusion of Drugs.—The indications for the application of the method of anodal diffusion of drugs may be summarized as follows :

To Produce Local Anæsthesia for Neuralgias, Superficial Pains, and Cutaneous Operations.—With an additional experience of nearly two years in the frequent treatment of neuralgias of superficial nerves with ten to twenty per cent. solution of cocaine on the anode, I can only reiterate my conviction that it is the best means we have for relief of the pain without constitutional effects. I have had no experience of the method in surgery, but I quote the following from a letter received from Dr. R. H. M. Dawbarn, June 10, 1889, which will merely serve as an instance of the successful employment of voltaic narcotism in a small operation :

"I have recently, since reading your article, tried this method upon a child's hand, requiring suture of a severed tendon. The injury was an old one, and there was no

wound before I made my incision. The anæsthesia from ten per cent. cocaine upon the anode, continued with my chloride of silver battery (twelve cells) for ten minutes, was very satisfactory."

I have experimented with other local anæsthetics. Aconitia produces a deep analgesia, but it is accompanied with severe smarting around the edges of the anæsthetized area. A combination of cocaine with the aconitia prevents this hyperæsthesia. I was led by a note on helleborin [1] in a medical journal to make use of this alkaloid as a local anæsthetic. Three or four drops of a one per cent. solution of helleborin on the anode have brought about much more gratifying results than cocaine, a deeper and more lasting anæsthesia, and I have never noted constitutional effects. The latter need not be feared now that dosage has become accurate. At the same time I should advise caution in the employment of so powerful an alkaloid.

Both onabain and strophanthin [2] (Arnaud's, not Merck's) are strong local anæsthetics, and may be used with the anode in doses of $\frac{1}{250}$ of a grain or more. One or two drops of chloroform on a tissue-paper disk placed upon the anode will bring about a deep analgesia in a very short time, but will be followed later by vesication. When it is desirable to first anæsthetize and then counter-irritate, chloroform cataphoresis may be advisable, and will prove useful in some neuralgias.

A mild solution of carbolic acid may also be employed as a local anæsthetic and analgesic.

For Topical Medication in various Local Lesions, such as Tumors, Rheumatic, Gouty, and other Swellings, various Skin Diseases, Syphilides, etc.—For such cutaneous disorders as are commonly treated by painting with iodine, the use of some of the iodine preparations, such as potassium, sodium, or lithium iodide, iodol, or diluted tincture of iodine upon the anode is indicated.

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[1] Venturini and Gasparini. Brit. Med. Journ., August 4, 1888.

[2] Fortschritte der Medicine, February 1, 1890.

For rheumatic and gouty swellings, solutions of the chloride, benzoate, or citrate of lithium, all very soluble salts, should be employed with the anode. Among mercurial remedies the imidosuccinate and bichloride of mercury are well adapted for cataphoretic purposes.

The rhinologist and laryngologist will find the method particularly adapted to the treatment of many difficulties of the upper air-passages which may require the application of anæsthetics, astringents, or antiseptics.

For Electro cataphoretic Baths for General Purposes.—There would seem to be considerable usefulness in the method as applied to mineral baths. Although Gärtner has been at great pains to invent a particular kind of bath-tub with two compartments for electrical purposes, it is not essential to have any such arrangement. By making an ordinary bath the anode, the hands may close the circuit by grasping a cathode suspended just above the bath. Thus almost the whole surface of the body may be subjected to the anodal diffusion of the therapeutic agent dissolved in the bath. Outside of tonic, stimulating, and alterative, such as are found in health resorts, cataphoretic baths of iodide of potash might prove useful in cases of lead poisoning, etc.

The Use of Cataphoresis for Diagnostic Purposes.—In the discussion which followed the reading of my first paper upon this subject, Dr. Starr called attention to the possible usefulness of cocaine cataphoresis in diagnosis. Thus if a pain were complained of, for instance in some part of the trigeminus, it should disappear under this treatment. If it did not, the lesion could be localized further back, or it might lead to the conclusion that it was a hysterical pain. I had myself an interesting example of its usefulness for this purpose some time ago. I was called in consultation to see a lady who had been suffering for months with a rather superficial but excruciating pain in the knee following slight trauma. The knee was swollen from blistering, the limb was rigid, the patient sleepless from pain and anxious to have the leg amputated. The spot upon which I placed the anode with cocaine was so hyperæsthetic that the slightest touch made her wince with pain. Her eyes being closed, I stuck a pin in the part after a few minutes, which she did not notice. When she opened her eyes, the electrode having been removed, I touched the anæsthetic part with my finger, and she winced with pain the same as before. Although the limb was, I believe, subsequently amputated, my diagnosis of a hysterical knee-joint was amply corroborated by microscopical examination.

In view of all the facts which I have adduced in this brief paper, there can be no doubt that the anodal diffusion of drugs is destined to far wider application than it has as yet enjoyed, and that the general practitioner and the specialist alike will find the procedure increasingly useful as a practical therapeutic measure. To close with a quotation from an editorial in the *New York Medical Journal*, December 28, 1889, it is a method that "opens a way not otherwise attainable for influencing tissue metabolism and for changing morbid nutritive processes by sending the drugs into direct and immediate contact with diseased parts through a force which in itself must greatly enhance their active medicinal properties."

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FUNDAMENTAL PRINCIPLES

OF

GYNÆCOLOGICAL ELECTRO-THERAPY;

APPLICATION AND DOSAGE.

BY

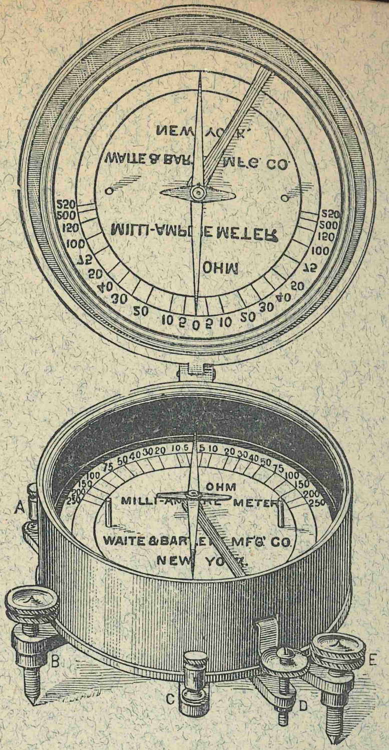
GEO. J. ENGELMANN, M. D.,

Professor of Diseases of Women and Operative Midwifery, Missouri Medical College and Post-Graduate School; President of the Southern Surgical and Gynæcological Society; President of the St. Louis Obstetrical and Gynæcological Society; Fellow of the American Gynæcological Society; Fellow of the London Obstetrical Society and of the British Gynæcological Society, etc.

FROM THE

JOURNAL OF ELECTRO-THERAPEUTICS,

May, 1891.



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FUNDAMENTAL PRINCIPLES OF GYNÆCOLOGICAL ELECTRO-THERAPY; APPLICATION AND DOSAGE.

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The use of electricity, especially of galvanism, has attracted a great deal of attention of late years among gynæcologists and has been widely resorted to, yet I can record no tangible progress in methods or results since I first presented this subject to the American profession in my paper on Gynæcological Electro-therapy at the Baltimore meeting of the America Gynæcological Society in 1886, when I could not even obtain a galvanometer in the city of Baltimore for the purpose of demonstrating my teachings.

In these four years the use of the electrical current has rapidly gained favor among gynæcologists by reason of the practical features of the new methods, which at once gave form and shape to a therapy which hitherto had been merely a vague something; and these features, the essentials of our present gynæcological electro-therapy, are:

1. The measures and dosage.
2. The direct application to the tissues.
3. The use of strong and effective currents.

In short, precision and the possibility of applying the current without those long sittings of twenty and thirty minutes, which hitherto have made its use an impossibility for the busy practitioner.

This questionable medium has become a valuable agent ; a very perceptible change has taken place in the profession ; the very men who, not long ago, denied the possibility of measurement and dosage, now appear as converts : the admirers of mild currents and half-hour sittings, continued for months, are hushed by the undeniable logic of facts, by the astonishing results achieved by effective currents in a few short sittings ; in short, medical electricity is now emerging from the primitive condition in which it has too long remained.

While commerce and industry have developed the most wonderful properties in this agent, and have utilized it to a marvelous degree, the medical profession has almost ignored it, though known for an entire century, since the time when Galvani, at sunset on a September evening 100 years ago, while endeavoring to suspend the legs of a skinned frog by a copper hook through the spinal column, to the iron railing of his garden terrace, observed the twicthing of the muscles when the copper hook touched the iron railing. This event marks the first progressive step in the history of electricity since the discovery of the remarkable property of amber, 600 years B. C.

Fertile brains soon developed the discovery of the Boulognese *savant*, which found favor especially among the French.

The most important advance in the use of galvanism as a medicinal agent is, however, due to the labors of

Remak, of Berlin, forty years ago, which we must accept as the basis of our work ; upon this we build.

Physiologists have developed the science, and neurologists have applied it, but the profession at large has gained but little ; indeed, we may say that the teachings of Remak have not been utilized as they should have been. Gynæcologists were not successful, because they merely followed the specialists, the neurologists, who had adapted the new remedy to their own particular purposes, in a very different sphere ; isolated, and even wonderful successes were reported, and created a temporary interest, which soon subsided. Even the success of Cutter, of New York, in the destruction of fibroid tumors, seventeen years ago, remarkable as it was, did not arouse emulation. The excellent results of Bruns, of Tübingen, in the treatment of goitre, and of nasal polypi, were noted by only a few and forgotten by them ; the brilliant application of the electrolytic properties of galvanism for the destruction of supernumerary hair in the eyelid, made by our friend Dr. Michel, of St. Louis, would have met with a similar fate had it not been made so valuable to dermatologists by our colleague Dr. Hardaway, so that among a limited number of specialists this one property of galvanism was throughly appreciated ; but to the profession at large the electric current still remained the same mysterious agent, regarded with indifference, with distrust, or with awe, until we learned, (1) measurement ; (2) localization, the limitation of effect to one active pole, which must be placed within the tissues ; and (3) the use of currents stronger than any hitherto applied in medical practice. Upon these fundamental laws is based the theory and practice of gynæcological electro-therapy.

Little can be said of the history of electricity in gynæcology; it has had no influence whatsoever upon the development of this rapidly progressing specialty; reference to even the latest and most thorough text-books affords the best proof of this fact.

Until quite recently the gynæcologist, unacquainted with the varying properties of the electric current, resorted to this remedy only when all other means had failed; in the most difficult and unyielding cases he tried an agent with which he was not familiar; he naturally failed and as naturally ascribed his failure to the remedy he used.

Need we wonder that no attempt was made to apply electricity in gynæcological practice, when Sir James Y. Simpson stated that, "Electrization of the uterus was all but useless, and that when uterine action had been apparently excited by galvanism it was *a mere coincidence*, or resulted from an impression made on the mind of the patient, or on the abdominal parietes by the electrode." Very little more advanced in his practice is Powell, a writer on medical electricity twenty years ago, who ridicules Simpson for this statement in his "Practice of Medical Electricity," published in Dublin in 1869. Though he tells us that the utmost care should be taken in recording cases, etc., he himself gives the following case histories: "Galvanism and faradism were applied for three weeks and with marked benefit"; or, "he was put under a course of galvanism, and in five weeks the power of the arm began to return."

This was a time when, in the famous Guy's Hospital, patients were treated by shocks from Leyden jars passed through the pelvic regions from the sacrum to the pubis, giving the very acme of what we most cautiously avoid in its mildest form—*i. e.*, shock.

But we can go down to the very latest literature without an improvement in that vagueness which has killed electricity as a medicinal agent. What is the practice of those who in their writings urge precision in application and measurement? What is the practice of those who preach exactness, and tell us that the want of progress is due to want of precision?

By their own case records we see that they themselves commit precisely the same error. The truth is that it is too much trouble for the busy and the competent gynæcologist; and unfortunately, the electrician, who is ready and able to closely watch his remedy, is no gynæcologist, and his observations are of little practical value.

Considerable confusion still exists, and galvanism and faradism, the ampère and the ohm, are not as *yet very thoroughly understood*; so we see one writer telling us that Apostoli applied *one and a half and two and a half ampères*; another says that while he formerly used only twenty-five milliampères, he now has applied as high as *ten ampères** (*ten thousand milliampères!*); another is recording the strength of faradic currents in milliampères. I shall endeavor to summarize the more practical points, so as to enable the practitioner to understandingly and effectively apply the current in gynæcological practice, but this does not refer to other branches of medicine.

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* *Ten ampères* is the current used for the large electric lights on our streets; inside lights in hotels and stores need a current of only six ampères. *Ten ampères*, through a resistance of sixty ohms, which is as low a resistance as we may expect in a fibroid, means a force of *six horse* power; this in electro-chemical force or heat would destroy the abdomen in a few moments. Any unlucky

As electricity for illuminating purposes differs from electricity as a motor, so does the electro-therapy of the neurologist differ from that of the gynæcologist, and I look upon the clear understanding of this distinction as absolutely essential to the development of electro-therapy; the want of it has been one of the most effective bars in the way of progress. Success was impossible with the indiscriminate application of electricity in the various branches of medicine; in gynæcology we deal with resistances of 200 and 300 ohms, as low as 40, but never above 600 or 800, while we use currents up to 250 milliampères, most commonly between 20 and 80 milliampères; the neurologist, on the contrary, rarely goes as high as 20 milliampères and usually uses from 2 to 5 milliampères, and the resistance of the tissues between his electrodes is from 5000 to 10,000 ohms and over.

The electrical current is merely the agent, and neurological and gynæcological electricity can be no more compared than any other remedy; than clinics or the knife as applied to one department of medicine or another.

An essential to successful gynæcological electro-therapy is a smooth current, the most complete avoidance of shock, which is, on the contrary, a valuable feature in the practice of the neurologist; we carefully avoid the effect of opening, closing, and reversing of the current, which is a highly important diagnostic and therapeutic resource in neurology.

Successful electro-therapy was impossible as long as electricity was looked upon as an agent applicable here and there in the same way, and it has been my aim to establish and develop gynæcological electro-therapy. As in all matters, if we wish to succeed we must ourselves work to our own especial purposes, I have, therefore, confined my work and my writing to the subject of *gynæcological electro-therapy*, and I wish it to be clearly understood that I make no reference to other applications.

The conditions are peculiarly favorable for the application of electricity to the female pelvic viscera:

1. The current can be confined to the part under treatment, as all the organs are gathered within the limits of the pelvis.

2. Diseased organs or morbid products can be reached directly by the electrode.

3. The low electrical sensibility of the parts makes the use of very strong currents possible. The skin, an electrically sensitive part, is not necessarily involved, and if so, only at the site of the indifferent or dispersing pole; as this is the abdomen, the current can be dispersed to any desired extent. The active electrode need never be in contact with the skin, and, however strong the current, the active intra-pelvic pole need cause no pain.

4. The polar method can, by reason of the situation of the parts, be successfully applied and fully utilized,

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fireman who for a moment touches non-insulated parts of a wire carrying a ten-ampère current is struck dead, and yet one enthusiastic electro-therapeutist claims to have applied a current of ten ampères to a living woman! Electric measurement is beginning to be appreciated, but is by no means understood.

and by this method only are speedy results possible in gynæcological practice.

I.—ESSENTIALS FOR THE SUCCESSFUL USE OF ELECTRICITY IN GYNÆCOLOGICAL PRACTICE.

The methods of use and application will be more readily understood after a brief recapitulation of the more important features of the essential characteristics of electro-therapy, as now applied in gynæcology, which are as follows:

a. Localization of the current.—The current must be localized and its effect confined as far as possible to the diseased organ or part.

b. Use of one active pole.—One pole exclusively, chosen for its peculiar properties, must serve as the active agent for the application of the current, and upon this its entire effect is concentrated; this is termed the active pole.

c. Dispersing of the current.—The current at the other pole must be neutralized as much as possible, and its effect rendered as little as possible perceptible; to accomplish this it is dispersed upon as large a surface as the configuration of the part will permit; hence, a dispersing electrode is used in connection with the indifferent or neutral pole, called the dispersing plate.

d. The active pole should be directly in contact with the organ or part to be acted upon, or even within its tissue.

e. The indifferent or *dispersing pole should be opposite to the active pole so as to confine the tissue to be affected between their surfaces;* it must be as near as possible

to the diseased part and upon the largest and least sensitive surface which can be untilized.

f. Use of effective currents.—Currents of sufficient strength to accomplish the object desired in the shortest possible time, without detriment to the patient, should be used.

The intensity of the current used in gynæcological practice varies from 1 to 300 milliampères; of most general use are currents of from 20 to 80 milliampères.

It must be remembered that I am not merely urging the use of currents as strong as possible, but of *currents strong enough to be effective.* While a current of one or two milliampères will relieve the pain of a contusion, a current of ten milliampères will aggravate it. The intensity must be commensurate with the object in view.

g. Precision in dose and measure.—Knowledge of the force used and exactness in dosing it are a *sine qua non* to the effective application of electricity. It is as necessary to know the electro-motor force of the elements and the milliampère intensity of the current used as it is to know the strength of a chemical solution, and the number of grains of the drug which are to be given.

h. Use of proper instruments is as necessary to the electro-therapeutist as it is to the surgeon. The battery, by which the force is generated, is useless without proper means of dosing and of applying it—the milliampèremeter; suitable electrodes for the application of the current at the active pole, and for its dispersion at the indifferent pole, are fundamental requirements for successful electro-therapy.

Upon the acquisition of these aids the recent progress of gynæcological electro-therapy is based.

i. Recognition and proper use of the various qualities of the electric current.—The electric current, both galvanic and faradic, is a most subtle agent, which may be made to serve many purposes, and which possesses numerous, greatly varying, and even antagonistic properties, which can be developed at will by the accessory apparatus and the method of application.

The following are the most important factors by which the properties of the electrical current are changed, and upon which its varying medicinal effect depends.

GALVANIC.	FARADIC.
varies with	
Intensity; number of elements.	Intensity; distance between primary and secondary coil; influenced less by electro-motor force of generating element.
Pole; negative, alkaline, fluidifying, stimulating; positive, acid, coagulating, sedative.	Pole; slight difference; negative, more irritating, painful; positive, less painful, more serviceable for deep application.
Time of use.	Time of use.
Constancy.	Number and length of interruptions; method of increase and decrease.
Size, shape, and material of electrode. Metallic for chemical effect. Moist, non-metallic, for distribution and penetration.	Size, shape, and material of electrode. Metallic for irritation. Moist, non-metallic, for penetration.
	Length and thickness of wire in secondary coil. High tension, effects on nerves by long secondary coil of fine wire. Quality and low tension, effect by short coil of heavy wire.
	Primary current more penetrating with metallic electrode.
	Secondary current more penetrating with moist, non-metallic electrode.

The therapeutic effects developed by the various

properties of the current, so changed, are numerous, and electricity may be applied to serve as a

Sedative.
Stimulant.
Counter-irritant and vesicant.
Muscle contractor.
Antispasmodic.
Tonic.
Promoter of development.
Absorbent.
Chemical cautery.
Coagulator.
Electrolytic.
Hemostatic.
Promoter of hæmorrhage.
Decongestor.
And as a medicator.

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II.—MANNER OF APPLICATION, ELECTRODES, AND INSTRUMENTS TO BE USED.

The greatest concern is generally felt in regard to the point of least possible importance—that is, the battery itself; the question, *What is the best battery?* is so often asked that I will again repeat that *this is immaterial as regards the effect.* The current is the same provided that the elements are of medium size, not too large or too small, whether we use the sulphate of copper telegraph cell, the zinc and carbon telephone cell, the Leclanché cell, or any of its modifications, or the ordinary medical dip battery. The physician must adapt his battery to his convenience and to his pocket. For stationary and cabinet batteries I deem the sealed Gonda Leclanché or the Diamond the most convenient; both with muriate of ammonia, zinc, and carbon; the former with the oxide of manganese disk in place of the porous cup, which is liable to clog. This battery works steadily, and requires the addition of distilled water every six months, cleansing and refilling every year. The fluid is simple, non-corroding, and odorless. Portable batteries are now made with similar hermetically sealed cups of smaller size, and these, of course, are far more convenient than the dip batteries, which have so long ruled; of these, the Stöhrer battery was the type. It seems, indeed, strange that in this progressive inventive country, from which all electric progress comes, these filthy, corrodable batteries should so long have remained the universal favorite. The hermetically sealed open circuit battery, with dry cups, or, at least, with harmless, odorless fluid, is the battery of the future for cabinet and portable purposes, but not as yet satisfactorily adapted to our purposes; the very admirable chloride of silver portable battery does not give a sufficiently strong or constant current.

The important instrument is the milliampèremeter, graded for general purposes from 1 to 100, for special work from 1 to 250 or 300. No work can be done without this, and it must always be in the circuit to be really useful.

The current selector I need not mention, as no battery is without one, and it is all important that we have this means of gradual increase of the current element by element, which I deem of more general utility, more simple, and almost as gentle as the rheostat.

The carbon or graphite rheostat, which is now supplied with many batteries, certainly affords the most delicate means of grading the current intensity, and, while by no means essential, is a very desirable auxiliary, and has partially supplanted the current selector, which I still prefer for ordinary purposes.

The wire rheostat to measure resistance, the interruptor, the metronome to break the current, the rheotome to change the current, the carbon or graphite rheostat to interpose resistance, or increase or decrease the current without even the slight jar occasioned by the insertion of single elements, are not necessary for ordinary work; but these, like the coulombmeter to measure the quantity of electricity, the voltmeter to measure the electromotive force of the elements, and the ampèremeter to measure their ampère capacity, are all demanded for progressive scientific investigation. That rather uncertain instrument, the water rheostat, has become almost obsolete.

The *electrode*, the most simple of all the accessories, and on account of its very simplicity the most neglected, is as important as the battery itself. I blame that despicable sponge electrode in part for the neglect into which electro-therapeutics have fallen in this country; every battery was supplied with two of these abominations, and as the practitioner soon found that he could not accomplish much with them, he thought electricity useless and put aside his battery.

The sponge electrode is a filthy, current-absorbing instrument, which must be cast aside. If a small electrode is wanted the metal plate can be used, covered with absorbent cotton soaked in warm water; this offers no appreciable resistance and is renewed without any trouble for each patient; in fact, time and trouble are saved, as it takes more time to soak thoroughly the sponge electrode than it does to cover the disk with absorbent cotton and apply this instrument, which is saturated by momentary immersion.

I propose to speak more fully of the *dispersing electrode*, as it is this which is so important, partially so from the fact that on account of its very simplicity it has been neglected. Electrodes for various purposes, for use in connection with what I call the active pole, have been devised in numerous forms to suit the locality in which they were to be used,—throat, ear, uterus, or bladder,—but where any but the mildest currents are to be applied these are ineffective unless the current at the indifferent pole is sufficiently dispersed. Only by rendering the neutral pole painless, by dispersing the current at this pole sufficiently to render it indifferent, can the other active pole be effectively used.

For this purpose then we must have an electrode of large surface and of good conducting material, so that the resistance it offers is reduced to a minimum. The stronger the current, the more intense the effect derived from the active pole, the larger must be the surface for its dispersion at the indifferent pole, and the larger must be this surface that the peculiar effects of this pole may be neutralized and that cauterization may be avoided.

The effect of the active pole is in no way reduced thereby, as the density of the current is not appreciably diminished in applications by the polar method, whether the dispersing electrode is large or small.

The larger this the better; its size is limited by the surface to which it is applied, and for gynæcological purposes three sizes are desirable:

No. 1. $6\frac{1}{4}$ by $9\frac{1}{4}$ inches = $58\frac{4}{5}$ sq. inches surface.
No. 2. $4\frac{1}{2}$ by $6\frac{1}{4}$ " = $28\frac{1}{2}$ " "
No. 3. $3\frac{1}{2}$ by $4\frac{1}{2}$ " = $15\frac{2}{3}$ " "

No. 3 is used with mild currents, and preferable when possible, as it is easily placed without disturbing the clothing, even under the corset; this should, as a rule, not be used with currents of over 15 or 20 milliampères.

Attached to a long, insulated handle, it makes a good spinal electrode; better for this purpose is one 3 inches by 5 inches, with the same surface (15 square inches).

No. 2 is still readily manipulated, though not so easily shifted from side to side, and must be used with currents from 20 to 60 milliampères.

No. 1 is necessary for intensities above 60 milliampères, if the current is to be applied without giving pain; to place this the clothing must be loosened.

These three sizes will generally suffice, although I have used No. 0, 8 inches by 10 inches, with a surface of 80 square inches, for the application of very high intensities in electrolysis, and No. 5 for cutaneous faradization, round, 2 inches in diameter, like the old sponge electrode.

I would urge these dimensions for general adoption in order that that uniformity which is so desirable to an understanding may be attained.

The electrode consists of a pliable sheet of lead perforated with holes one line in diameter, one inch apart, and is covered with a layer of punk or absorbent cotton, which is held in place by a thin buck-

III.—Dose and Measure.

For proper *dosage* the following elements are required in

Galvanism.	Faradism.
Milliampère intensity of current.	Strength of current by distance between primary and secondary coil.
Time of application, by which quantity of electricity used is determined.	Time of application.
	Number of interruptions.
Square surface of dispersing electrode, for record of density.	Size, shape, and material of electrode.
	Tension and quality of the current as determined by the length and thickness of the wire in the secondary coil.

Other measures by which all details of the application are recorded with precision for scientific research, though not necessary for simple treatment, are the following :

Galvanism.	Faradism.
Resistance of the tissues and electrodes in ohms.	Resistance of the tissues and electrodes in ohms.
Density of the current.	
Quantity of electricity used expressed in coulombs.	
Electro-motive force of the elements used in volts. Ampère capacity of the elements used in ampères.	Electro-motive force of the elements used in developing the current and their ampère capacity in ampères.

The galvanic current, thanks to its commercial value, can now be measured and dosed with the utmost precision, and all its practically important characteristics can be more accurately recorded than those of any other medicinal agent. For all practical purposes—I am speaking only of the application of galvanism by the polar method, in gynæcological practice—we need only know the *intensity* of the current in milliampères, the *time* of application, and the *site, nature, and size of the electrodes.*

The *resistance* of the tissues in ohms is not practically necessary, as in gynæcological practice we know that the resistance varies between 60 and 800, usually between 200 and 300 ohms, and this is more closely indicated by the location of the poles, as the physician who applies electricity judiciously and scientifically should know about what the resistance of certain parts generally is.

The *density* of the current, however important in other methods or in other localities, varies but little in gynæcological treatment by the polar method, as it is practically the same in all but the intra-polar applications, as, for instance, to the ovaries. The active pole being always small, either stylet or ball, the effect sought in its immediate vicinity differs but little whether the current is dispersed upon a large or small plate. Still, I have named the location and size of the dispersing electrode among the elements necessary for dosage and record ; by means of this the density can be calculated, though I have included it, not for this purpose as much as for the convenience of the physician to facilitate repetition.

The practically important elements for record and dosage of faradic currents are the electro-motive force of the generating element, with the distance between the coils, the character of the secondary coil, and the number of interruptions per minute; but this will only be possible with perfect standard instruments, such as the apparatus of Gaiffe in Paris, and the Engelmann Battery of Waite & Bartlett, of New York. The utility of this form of electricity has not as yet been recognized, on account of the imperfect apparatus in the hands of the profession, which really serves but one purpose—that of stimulation.

The ordinary faradic battery is a dangerous instrument in gynæcological practice, more liable to do harm than good, by reason of its stimulating and exciting properties; but admirable results follow the use of properly modified faradic currents, and such as can be dosed and compared with an approximate precision.

The large instrument of Gaiffe and the Englemann battery of Waite & Bartlett are the only ones which admit of exactness in application and observation; the intermission can be regulated and timed from 1 to 3000 per second, and a set of secondary coils of known length and diameter permit us to utilize and record all the various qualities of this admirable agent.

The determination of the milliampère intensity of a faradic battery is more than useless; it is deceptive, as the ampère intensity carries no conception of the true force of this kind of electricity, which is produced by induction, and by frequent making and breaking of the current.

If passed through a coil of long wire the milliampère intensity is greatly reduced, and yet the effect of the current is increased. I mention this only to prevent entanglement by the erroneous ideas advanced by some who have claimed to measure the faradic current by the milliampèremeter.

Measure and Dosage of Galvanism.

The milliampèremeter.—Upon the use of this instrument, absolutely essential to successful practice, the present advance in gynæcological electro-therapy is based. The instrument may be either horizontal (tangent) or perpendicular, and for gynæcological purposes should indicate from 1 to 250 milliampères. While the neurologist may need one with more exact reading from 1 to 10, enabling him even to distinguish one-half or one-quarter of a milliampère, the gynæcologist must have wider scope, and, as a rule, exactness to a single milliampère is not essential; the intensity usually employed is from 10 or 20 to 60 or 80 milliampères; in rectal, urethral, and vesical applications, the want of an instrument plainly showing fractions of a milliampère is sometimes felt, as two or three milliampères only are used; but in general use this is unnecessary.

The high intensities are needed for purposes of electrolysis or cauterization.

Time of application is noted in minutes, and from this the quantity of electricity applied in the entire séance can be determined in coulombs, the unit of quantity.

For ordinary purposes the record of time only is needed. The importance of this element in determining the effect is self-evident.

Density.—Square surface of Dispersing Electrode.—This should be recorded to facilitate repetition, and, if desired, to determine the *density* of the current, which is of extreme importance in certain methods of application.

To simplify record, and further an understanding, it is very desirable that practitioners should adopt standard sizes of this important instrument; uniformity in size and even in conducting powers of dispersing electrodes is essential, as it is difficult to calculate with ever varying factors; but if a standard be adopted this difficulty is obviated.

The three sizes I use I would suggest as most convenient for gynæcological purposes:

No. 1, 59 square inches surface ($6\frac{1}{4}$ by $9\frac{1}{4}$ inches) for higher intensities.

No. 2, $28\frac{1}{2}$ square inches surface ($4\frac{1}{4}$ by $6\frac{1}{4}$ inches) for intensities from 20 to 60 milliampères, still applicable to the abdomen without difficulty.

No. 3, $15\frac{2}{3}$ square inches ($3\frac{1}{2}$ by $4\frac{1}{2}$ inches), easily manipulated and readily slipped under the clothing upon any part of the abdomen, can be used for all milder applications, and even with 40 milliampères if the patient be not too sensitive and the resistance low.

Resistance of the Tissues and Electrode in Ohms.—The ohm is the unit of resistance, and is measured by the rheostat. Upon the resistance of the tissue depends the intensity of the current possible and necessary.

The *greater the resistance* the *less the possible working intensity* of the current, but the *greater the electro-motive force* and *ampère capacity of the generating battery* required. Hence the possibility of successful application of galvanism in gynæcological practice; the resistance offered by the tissues is small, usually 200 or 300 ohms; and under these circumstances the patient

can stand 100 or 200 milliampères; in percutaneous applications, as required in neurological practice, the resistance of the tissues is rarely as low as 1000 ohms, often 5000 and 10,000 ohms, and 5 milliampères is then a great intensity, requiring strong battery force. In neoplasms and effusions, in which the highest intensities are required, the resistance is sometimes reduced to as low as 40 ohms, and at most it is never above 600 or 800 ohms. The resistance of the moist tissues is very low, and the nearer the electrodes can be approached to each other the less it is, as the amount of tissue is diminished.

The greatest resistance is offered by the dry epidermis, and in gynæcological applications this is only to be encountered once, and not in all treatment; then the epidermis on the abdomen is not so thick and hard, and the surface is so located that it can be well saturated. When both poles are intra-pelvic the resistance is naturally lessened, and very little ampère capacity of battery is required. The resistance in these applications is also lessened by the approximation of electrodes, the one in the vagina, in the uterine cavity, or in the tissue, comes very near to the other, over it upon the abdomen. Most effective, however, is the succulence of the tissues in reducing resistance, and these tissues, with the exception of the abdominal walls, possess low electrical sensibility. For these reasons the use of effective currents, inapplicable in other parts, is possible in the pelvic viscera. This is best explained by an example: In an electro-cauterization of the endometrium, with one pole, the sound, in the uterine cavity, and the other, the small plate, upon the abdomen, I can use 30 milliampères with but little pain, and may need 6 elements to develop these 30 milliampères through a resistance of 250 ohms. If I place the same small abdominal electrode on the back of the hand, and in place of the uterine sound, at the other pole, a round electrode in the palm of the hand, I will find a resistance of 3500 ohms from palm to back of hand, and I will need 24 of the same elements to obtain 4 milliampères, and these 4 milliampères will cause as much burning as the 30 milliampères through less resistance, and in a more sensitive spot.

For an exact determination of the resistance of the tissues, the resistance of the electrode must be noted. That a knowledge of the resistance of the tissues under treatment is necessary, is evident from the influence of this factor upon the result. For general purposes of gynæcological treatment, however, it can be dispensed with, as this resistance varies within known and narrow limits; but for other applications it must be noted, as the variation is very great, and so much depends upon it.

I myself have recorded the resistance in the cases treated, for the sake of study and observation, and believe that this should be done for the purpose of scientific observation, that rules of practice may be developed.

It is to the low resistance and slight degree of electro-sensation that gynæcology owes the possibility of successful electro-therapy; 250 milliampères can be applied for electrolysis in a uterine fibroid, because the resistance may not be over 60 milliampères, and this can be accomplished without excessive pain, or the use of great battery force; while

250 milliampères, sent through the body from hand to hand, would cause instantaneous death; and no battery—nothing but a dynamo—sends such a current through a resistance of 15,000 ohms (at which I roughly estimate the tissues from hand to hand).

Density of the Current.—The greater the density of the current the more intense the effect, and, as we have seen, in gynæcological electro-therapy and the polar method, the greatest density is attained, as the effect is derived from the surface of one small pole, and the density of the current in the tissue surrounding this active pole varies but little whether the dispersing electrode be large or small; hence, as has been stated, for mere working purposes, the record of this factor is of no value in gynæcological electro-therapy, however important it is in other applications. The density has been expressed by the milliampère intensity divided by the square electrode surface, $\frac{\text{1 milliampère}}{\text{square surface of electrode.}}$ It is an element which can be dispensed with practically in dose and record of gynæcological electro-therapy; though of interest for investigations of scientific precision, and application to other parts. It is only in ovarian and similar intra-pelvic intra-polar applications that we must take into account this element of density.

Quantity of Electricity used.—The Coulombmeter.—The coulomb is the unit of quantity, and is represented by the quantity of gas developed by a current of one ampère in one second of time, or by the amount of water displaced by the gas evolved by a current of one ampère in one second of time; in other words, a coulomb is the quantity that passes in one second of time against one ohm of resistance under the electro-motor force of one volt. One coulomb will decompose 92 microgrammes of water, and upon this decomposition the instrument for measurement is based; though not scientifically exact, like the milliampèremeter, it is sufficiently so for practical purposes.

In gynæcological practice it is sufficient to calculate the amount of electricity used, which is easily done if the intensity of the current and time of application are known: As one ampère for one second of time equals one coulomb, $\frac{1}{1000}$ of an ampère, or one milliampère, will equal $\frac{1}{1000}$ of one coulomb, in one minute, 60 seconds, will equal $\frac{60}{1000}$ or $\frac{6}{100}$ of a coulomb, and in five minutes, $\frac{30}{100}$ of a coulomb. The current used in an ordinary application, for instance, 20 milliampères for 5 minutes, equals 20 × $\frac{30}{100}$, or 6 coulombs; the same as if a current of 100 milliampères was applied for 1 minute, or of 1 ampère for 6 seconds.

I have made the measurements and calculations in my case records for the sake of observation and comparison, but I do not deem it necessary if milliampère intensity and time of application are given; it is merely one of the methods of measuring the galvanic current in all directions for precise determination. If a milliampèremeter is not at hand, the quantity may be measured by the coulombmeter, and, the time being known, and the resistance, the milliampère intensity may be calculated.

Electro-motive Force; the Voltmeter.—This is one of the measures used for determining the initial force of the agent, the power of the battery, or of the cells

used in the treatment. One volt, the unit of electro-motive force, is a force sufficient to produce a current of one ampère through one ohm of resistance—that is, about equal to that of one chloride of silver, or of one Daniell, element.

The voltmeter used for measuring the electro-motive force is an instrument similar in appearance to the horizontal galvanometer, indicating the force in degrees of deflection of a needle, which is impelled by the current passing through a coil of high resistance underneath the pointer. This instrument is of service in determining the value of a battery for galvano-caustic purposes, and for recording the force of the elements used, but is superfluous in galvano-therapeutics for all but exact scientific work; it is not necessary for determining or recording the electric dose, but serves rather to define the status of the battery and of the elements used in the treatment; it tells us whether they are in perfect working order, whether they are deteriorating, and how they have been influenced by work or exposure.

The ampèremeter is used to determine the ampère capacity of the battery, or of the elements used in a given treatment; by this instrument, which is similar to the tangent galvanometer, the intensity of the current used for galvano-caustic purposes is determined, and it is our best means of recording this. In galvano-therapeutics it is useful for control of the battery and its elements, and by it the ampère capacity of the elements, used for a given application, or the initial intensity of the current may be determined. It is, of course, not kept constantly in the circuit, like the milliampèremeter, but is inserted in place of the body and milliampèremeter, after the application has been made, to show the intensity of current as coming direct from the battery. It is of no importance to the practitioner, but cannot be dispensed with for a complete determination of all elements; by the ampèremeter, knowing the milliampère intensity of the current in an application, we can calculate the resistance of tissues and electrodes, and, as by the voltmeter, we can record the condition of the elements before and after a séance.

This instrument takes the place of the milliampèremeter in all cases in which no such high resistance, as in medical treatment, is interposed. In gynæcological electro-therapy this measure is unnecessary for practical work, as the efficiency of the treatment cannot be determined by the battery force used, on account of the great resistance interposed, it serves us only for an understanding of the working power of the battery, and of the currents used in treatment, but for electro-cauterization and for mechanical purposes this is the gauge by which the work is measured. The ampèremeter is for the machinist, the electro-plater and electro-lighter, what the milliampèremeter is to the medical practitioner, who employs but an infinitesimal part of the electric intensity needed by the former.

Faradic Dosage.

The only precise measure applicable to faradic electricity is the electro-motive force and ampère capacity of the generating element, but these affect the therapeutic result too little to be considered in dosage. They are recorded only for scientific purposes.

For purposes of dosage we must as yet content ourselves with a rehearsal of the conditions by which the effects of the faradic current are determined.

Strength of the current is indicated by the distance between primary and secondary coil, as shown by the scale, but until a uniformity of instruments is achieved, this is of value only to the operator himself.

Time of application, of course, determines the effect and should be recorded.

Number of interruptions, which in my instruments, in the Waite & Bartlett, and the Gaiffe, vary from 50 to 3000 per minute, is an important feature of the application and must be noted as one of the determining factors.

Size, shape, and material of the electrode affect the result greatly, and should be noted.

Tension and quality of the faradic current are perhaps its most important therapeutic factors, as the effect varies greatly with the nature of the secondary coil by which these are produced, hence this must always be noted.

A coil of long and fine wire gives high tension and little quality, while a short coil of heavy wire gives greater quality and less tension. By a current of tension the pain of a cellulitis will be relieved, but the pain and swelling from a contusion will be aggravated; by a current of quality and low tension the pain of a cellulitis would be aggravated, the pain, œdema, and venous distention of a contused surface will be alleviated; the former is used mainly for nerve, the latter for muscular effects.

Resistance of the tissues is of no practical importance, as we have no measure of faradic intensity corresponding to the ohm as the ampère does. It is noted only for experimental purposes and future possibilities.

Nomenclature.—I will here again call attention to the nomenclature which I have employed and which I have urged for general adoption, in my first paper, so that the recording of cases may be simplified and a general understanding facilitated.

The method of application is described by the location of the poles, the site of the active pole being named first, that of the indifferent or dispersing pole following.

Thus, in speaking of a *utero-abdominal faradization*, I refer to the application of the faradic current with the active pole in the cavity, and the indifferent pole on the abdomen; by *intra-uterine galvanism* I have indicated the bipolar treatment—that is, both poles in the uterine cavity. If the word negative or positive precedes, this always refers to the character of the first named, the active pole, viz., *positive recto-abdominal galvanism* tells us that the active positive pole is in the rectum.

The application of the bare metal pole to a surface with higher intensities of current is termed a cauterization. Thus, a *positive electro-cauterization* of the uterine cavity expresses in a concise form the application of the bare metal or carbon electrode, connected with the positive pole, to the uterine cavity, an intensity above 20 milliampères being used, while the current is dispersed at the negative pole upon the nearest available surface, the abdomen. When the cauterizing metallic pole is replaced by a non-metallic pole, such as a cotton-wrapped applicator, I term this treatment *positive utero-abdominal galvanism.*

Puncture is the introduction of the needle or stylet, the metallic pole insulated to within one-eighth inch of the point, directly into the tissues with dispersion of the current upon the nearest available surface; a *negative electro-puncture* of a fibroid is the electrolysis by a stylet in connection with a negative pole inserted into the tissues of the fibroid, the current being dispersed upon the abdomen in the positive electrode. If this puncture is made *per vaginam*, we speak of a *negative vaginal electro-puncture.*

Record of dose.—I have stated that intensity of current in milliampères, time of application, and square surface of dispersing electrode are necessary for determination of dose; to make this still more exact, I have always added a description of the active pole. An electro-cauterization of the uterine cavity I have thus precisely recorded:

—E. C. 20 milliampères, 5 min. Fine probe. II. Plate.

i.e., 20 milliampères were applied for five minutes with the fine—Sims's—probe as negative pole in the cavity, and II. plate, with a surface of $28\frac{1}{3}$ square inches as the positive dispersing pole, on the abdomen.

This is the therapeutic application and dose fully defined.

In cases recorded for research with scientific precision other data are added; these I have arranged in the following manner:

—E. C. 8 Gonda Leclanché elements $10\frac{2}{3}$ volts, 0.63 ampère. Sims's probe, II. Plate; 20 milliampères, 5 min., 6 coulombs; 600 ohms resistance (tissues 586 ohms, II. Plate, 14 ohms).

This, in addition to the data essentially necessary for dosage, tells us that for this treatment 8 Gonda Leclanché elements were used, with an electro-motive force of $10\frac{2}{3}$ volts, and an ampère capacity of 0.63 ampère; that the quantity of electricity used in the treatment with effect upon the patient was 6 coulombs; that the entire resistance offered these 0.63 ampère of current, which allowed the use of 20 milliampères effectively on the patient, was 600 ohms, which is essentially referable to the tissues, but an examination of the dispersing plate shows that this offered a resistance of 14 ohms, which leaves 586 ohms for the tissues, the resistance of the apparatus and rheophores being trifling.

The dose of a faradic application I have recorded in the following manner:

+V. A. Faradism, 4 min. 6 cm., 1500 I. Fine coil.

Or, in other words, the positive cotton-covered ball electrode in the vagina, the small dispersing plate on the abdomen, used for four minutes, the secondary coil 6 cm. from the primary coil, 1500 interruptions per minute, a current of great tension and little quality, the long coil of fine wire as secondary helix.

When I first advocated attention to measure and dose, being deeply impressed with the importance of precision and in application and observation, I was obliged to secure instruments of foreign manufacture, but many were deterred from utilizing the agent by the difficulty of procuring suitable apparatus, or its absence from the home market; others, especially those who have assumed prominence heretofore in electro-therapeutic science, denied the practicability of precise measure, and in the face of my claim for a progressive move and effective doses, urged mild applications. A change has now been effected, the

demand for instruments of precision has created a supply, and while when five years ago, I first urged the importance of dosage, hardly a milliampèremeter was to be had on this side of the Atlantic, and the galvanoscope was sold as a galvanometer, the market is now being supplied,* and the working members of the profession are beginning to test the value of galvanism applied with precision and judgment, and those who not many months ago still upheld the theory of mild currents tested on the tongue, and long applied, are beginning to vaunt the effective strong current measured in milliampères. Erb and others have long since urged the importance of dose and measure, but a standard has not been adopted; the

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* While I have the instruments of the best makers, and utilize them for purposes of comparison, I have worked altogether with the Gaiffe milliampèremeter, which is the most convenient and reliable, preferable to all but the Waite & Bartlett, by reason of its low resistance: a resistance of less than one ohm, which causes no loss of current as other meters with high resistance do.

The American instrument, of Waite & Bartlett, which I have recently worked with, possesses all the advantages of the Gaiffe, and, as now offered to the profession, is equally serviceable.

The advantage of these two instruments lies in their reliability and their low resistance, but each instrument should be carefully examined before using. Every physician should test his galvanometer or have it tested by an expert electrician.

The most delicate test of the correctness of the instrument is the test of the intensity of the current by the amount of silver (or copper) deposited by it in a given time.

The simplest test, and sufficiently correct for instruments such as are used in medical practice, is by Ohm's law, $I = \frac{E}{R}$. Every physician can thus test his own galvanometer, if he has a rheostat and a cell of known electro-motor force and known internal resistance, and if the resistance of his galvanometer be known.

The test is made as follows:

$$I = \frac{E}{R} \text{ or Intensity} = \frac{\text{Electro-motor force}}{\text{Resistance.}},$$

Resistance consists of resistance, or R, of galvanometer plus internal resistance of cell plus a certain rheostat resistance, which must be in a milliampère

Weber would not yield to the ampère or the Siemens unit to the ohm, the instruments were rare and costly, and, above all, those who urged precision and measure did not themselves set the example. In but few instances do we find case histories so recorded that the dose is stated with precision. Apostoli gave us the milliampère intensity; this was a most important step forward; also time of application, and the size of the electrode could be inferred. All the essentials were indicated, though not given for the purpose of thus noting dose; these I have systematized, and I believe that I can say that a correct and serviceable dosage has thus been attained.

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test, 1000 times E less (galvanometer R + internal cell R). Thus, if I take my Gonda-Leclanché cell

$E = 1.3$ volts.

$R = 2$ ohms.

R of my galvanometer 0.4 ohm.

I or one milliampère $= \dfrac{1.3 \text{ volts.}}{1300 \text{ ohms.}}$

0.001 m.a. $= \dfrac{1.3 \text{ volts}}{1300 \text{ ohms}}$. 1300 ohms $= R = R'$ of cell $+ R''$ of galvanometer $+ R'''$ of rheostat.

$$0.001 = \frac{1.3}{2 + 0.4 + 1297.6}.$$

In other words, my Gonda cell must show exactly one milliampère on a galvanometer, the R of which is 0.4 ohm, if I insert a rheostat R of 1297.6 ohms. This brings me to the great fault of many of the milliampèremeters in the market which lies in their unnecessarily great resistance, varying from 90 to 130 ohms; while the Gaiffe and the Waite & Bartlett instruments offer only 0.3 to 0.9 ohms resistance.

To the neurologist, who deals with resistances in the human body of 3000 to 30,000 ohms, this galvanometer R of 90 or 130 ohms is of no import; but to the gynæcologist it makes a great difference; in his treatment of the pelvic tissues, which offer a resistance of from 60 to 300, a galvanometer R of 130 is an important factor.

Why waste as much battery force in overcoming the galvanometer R as is needed to overcome the R of the tissues? It is a needless loss of power, and herein lies the great advantage of the Gaiffe galvanometer, which offers an R which can be practically overlooked—less than one ohm.

Now that a serviceable faradic battery has been placed within reach of the profession, the admirable properties of this form of electricity will become more generally known. The varying effects of faradism depend upon a perfect grading of the interruptions and the proper winding of the coils, and a proper grading of these coils. Strange as it may seem, several writers, and even recent writers, deny the varying effects of long and short, fine and heavy wire coils; I cannot argue such palpable facts, which every student in my clinic has become familiar with, which he has again and again seen. I can only believe that they have never had the proper instruments to work with, and in fact until quite recently no such instrument has been made, with the exception of the large faradic battery of Gaiffe, for physiological purposes, which was accessible to only a few. The battery made by Waite & Bartlett of New York, in accordance with my suggestions, and called by them the Engelmann battery, is the first American instrument with variable interrupted and graded coils which can be used to advantage.

The faradic current, properly applied, accomplishes a variety of purposes: the effects of currents through the different coils varies as much as that from the different poles of the galvanic battery; one gives pain, the other eases; one reduces swelling, the other aggravates it; one gives a feeling of heat, the other of cold. I can merely substantiate what I asserted years ago, and urge upon the profession a trial of faradism, with the three-coil battery, with perfectly graded interruptor.

IV.—THERAPEUTIC USES OF ELECTRICITY.

In Gynæcological Practice.—The electric current is most useful in chronic conditions, but is also applicable in subacute stages; less so in acute inflammations, in which the greatest judgment and delicacy of manipulation is necessary. It is an error, however, to suppose that acute conditions contra-indicate the use of electricity; nothing so readily relieves the intense suffering caused by rhuematic inflammation as the electric current, which I have known to succeed when all other means—even opiates—have failed. The sedative influence of faradic currents of high tension quiets the irritability of nerves and vessels, and Remak already has taught the quieting action of a mild anelectrotonus on nerve and muscle, as well as on the vasomotor tracts, and has so treated contusions and inflammatory swelling. To gynæcologists the field is new, and I am confident that excellent results will reward the investigator; the application is comparatively unknown on account of the scarcity of material, since the battery is not carried in a pocket-case by the practitioner, and acute diseases do not present themselves in the office—where the battery is stationed; they are at home, in bed; moreover, all teachers have concurred in the unfounded statement that the use of electricity must be confined to chronic conditions.

Both galvanic and faradic currents are effective when used, either alone or in connection with other remedies, in the treatment of many of the most troublesome of the tedious disorders of the female pelvic viscera. I have obtained excellent results from electricity in the following conditions:

1. Neoplasms of various kinds: fibroids, polypi, and cystic growths, urethral caruncles, and hæmorrhoidal tumors.
2. Chronic pelvic inflammation with induration and extravasations, parametritis and perimetritis.
3. Uterine hyperplasia.
4. Chronic ovarian inflammation.
5. Occlusion of the os and stenosis of the uterine canal; atresia.
6. The relief of engorgement and the accompanying pain.
7. Subinvolution.
8. Prolapsus uteri, when due to the relaxation of tissue.
9. It is a valuable aid in the correction of various forms of displacement.
10. Metrorrhagia, whether due to neoplasms or relaxation of tissue.
11. Certain forms of amenorrhœa.
12. The relief of many of the annoying reflex symtoms; the hystero-neurosis.
13. Chorea and other nervous disturbances accompanying puberty and the menopause.
14. Constipation due to inactivity of the muscular walls and dilatation of the rectum.
15. Painful or difficult micturition, when due to spasmodic contraction or relaxation.

In Obstetrics.—It has proved a valuable therapeutic agent for the relief of the following conditions: 1. Uterine inertia, during and after labor. 2. Weakness and irregularity of labor pains. 3. Post-partum hæmorrhage. 4. Imperfect involution. 5. Paralysis of urethra and bladder after labor. 6. Extra-uterine pregnancy.

For the induction of premature labor, for which this agent has been of late greatly advocated, I have never used it, for the reason that we have better means, equally effective and physiologically more correct, to accomplish the same object, and I would not recommend it, though I am sure that it would prove serviceable.

I deem it wrong to inaugurate premature labor by uterine contractions; we should follow the course of nature, in which I take the muscular contractions to be but secondary, the result of over-distention, and the separation of tissue by reason of degeneration, thus making the ovum a foreign body and an irritant, which then arouses the contractile fiber to activity. Hence I believe that the warm douche for the softening of the tissues, and the introduction of the soft catheter between chorion and decidua, if the former fails, are the correct means, and stimulate the natural process most closely.

For all the above conditions I do not advocate electricity as the only remedy, but as equally worthy of trial with other remedies; it is valuable and effective in some cases only in connection with other means; but in others it is the main or only therapeutic agent.

In cases of hæmorrhagic and unoperable fibroids, in certain forms of chronic perimetritis, in amenorrhœa and subinvolution, in hyperplasia and stenosis, I consider the electric current as the most valuable and effective method of treatment. In others it is merely

an aid to treatment, as in prolapsus uteri, by contracting and strengthening the weakened tissues; while in still another class of cases, however effective, it is but one of more means toward accomplishing the same end, and unless a battery be on hand, or certain peculiar reasons for its use exist, the practitioner will adopt means with which he is more familiar, as in post-partum hæmorrhage, while a faradic current of low tension, or the positive pole of the galvanic battery with occasional interruptions, will overcome this dangerous condition as certainly as the intra-uterine injection of hot water or the perchloride-of-iron swab, there is then no particular reason for using this cumbersome apparatus.

The method of application can be best exemplified by an individual case, and I will describe my procedure in the treatment of a uterine fibroid. Attention to the minutest details is necessary to success and to the comfort and safety of the patient. The consent of the patient must of course be obtained, as in case of any operative interference, and she should be given an idea of the treatment, that she may not be nervous and restless, but remain perfectly quiet during the action of the remedy. She may be promised that she will receive no shock, which embodies the idea of electricity to the laity, and is what ladies most dread; she can be assured that she will suffer no unbearable pain; that she will experience no discomfort whatsoever within, but that there will be a burning—not excessive—outside upon the abdomen. The corset is removed, the skirts loosened so that respiration may be free, and the abdominal plate, warm and well moistened in simple hot water, is snugly adapted. The patient takes her place upon a gynæcological operating table or chair, in the dorsal decubitus, the thighs flexed precisely as for ordinary treatment. The electrodes needed are a gold or platinum sound of ordinary dimensions, and a delicate needle or stylet of the same material (though the steel instrument may be used), well fixed in a firm handle ; for puncture through the vagina, this instrument should be of a length equal to that of other gynæcological instruments, sound or applicator ; for the sound we must have a separate insulator of heavy rubber—better still, of glass, which may be kept more thoroughly aseptic. The abdominal or dispersing electrode is a thin plate of lead or tin alloy, as large as it can be used upon the abdomen, averaging six by nine inches, covered with a thin layer of sculptor's clay, held in place by gauze, or with punk or absorbent cotton and a soft, thin buckskin cover, which is equally good.*

The shape which admits of the use of the largest possible plate is the oval, or, better still, the modified form of my plate, oval with convexities to avoid the thighs. This electrode is thoroughly soaked with water as warm as is comfortably borne,† and snugly adapted to the abdomen, that it may rest in place a few minutes before treatment is begun, the current then passing more readily, with less pain ; the friction, as I may say, caused by the efforts of the electric current to pass the resistance offered by the dry epidermis being possibly a source of pain, certainly lessening the effect of the current by loss of intensity in overcoming the greater resistance. If this precaution is not observed, the operator will find an intense burning during the first few minutes, which lessens, however, as the tissues become soaked ; the desired intensity having been attained, notwithstanding that no more cells are inserted into the circuit, the galvanometer will indicate an increase in high intensities of as much as 10 milliampéres, and yet the pain lessens decidedly if the positive be the dispersing pole. I have even seen it rise from 50 to 100 milliampères, without augmenting the number of cells, when the abominal plate had not been placed until the last moment, so that the dry epidermis offered a resistance at first difficult to overcome. In other words, when the epidermis becomes soaked, less resistance is offered, more electricity passes and if the positive be the dispersing pole the pain is lessened by the anæsthetic effect of the pole, diminished at times to a minimum, though the intensity of the current be increased. Before placing this plate we must examine the abdomen to see if it shows any abrasions or excrescences ; if so, they may be covered with a small piece of oiled silk or plaster, as such a spot would be the center of intense pain if not guarded. An abrasion, a small blister where the epidermis is removed, centers upon itself much of the electric force, which always seeks the best conductor ;

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* Apostoli lauds the sculptor's clay as superior to all others. I am using the punk and buckskin-covered plate, and have attained equal success. I have used equally high intensities, with a minimum of pain to the patient and no eschar. Since punk is difficult to obtain in this country in large sheets, absorbent cotton may be used ; a thin, even layer of this, quilted smoothly under the chamois cover, makes as good a conducting electrode as punk or clay. The quilting is easily done with my perforated metal plates.

† Electrodes which offer so little resistance as these I recommend must be soaked merely in hot water ; salt should not be added, since it injures the electrode, and does not add sufficient to the conducting powers of the instrument to counterbalance the accompanying disadvantages—greater burning, especially on mucous surfaces, and destruction of the electrode by electrolytic action upon the salt solution.

or, if an excrescence, the increased pressure would cause a concentration of the current at this point. The plate having been placed, it is covered by a warm, dry towel, or a piece of oiled silk, to guard all garments in contact with it from moisture, which may lead to serious colds, to injury as well as mere discomfort.

The stylet or sound, whichever is to be used, is steeped in a strong antiseptic solution, as is also the glass or rubber insulator; the vagina should also be cleansed. For electro-cauterization the sound, covered up to two inches of the point by the insulator, is introduced into the uterine cavity with the utmost care; if possible it is preferable to introduce the sound by the sense of touch. If the stylet is used for electro-puncture, the point of entry having been carefully decided upon, the instrument is introduced, the point guarded by the index finger of the left hand, the handle grasped firmly by the right, counter pressure being made upon the abdominal protuberance. The puncture is then made, the delicate point of the stylet is introduced through the cervix or vaginal vault, just deep enough to give the current a point of entry into the morbid tissue, and to carry the exposed metal beyond the vaginal wall, which itself should not be subjected to its action. The activity of the battery is now tested, the rheophores are attached to the electrodes and the screws firmly bound; the galvanometer-needle must point directly to zero. The abdominal plate, evenly adapted everywhere, is held down with gentle pressure by the hands of the patient, while the operator either fixes the sound or stylet with an absolutely steady hand, or rests it upon some suitable support, as the

slightest motion, any jarring of cords or battery, in portable batteries, must be avoided. The patient must breathe evenly and steadily, and allow her hands to follow the respiratory heavings of the abdomen; we must see that the thighs nowhere touch the edge of the electrode, and if perchance the probe is to be passed through a speculum the slightest contact of its metal surface with the pole must be avoided. When any pain or discomfort that may have been caused by the introduction of the instrument has ceased, the current is established and gently increased, in the first sitting, in the course of a minute up to 50 or 100 milliampères; later, when the sensibilities of the patient have been tested, 150 to 200, and even 250 milliampères may be attained in the same time. For very sensitive patients I use the water-rheostat, by means of which we can attain the desired intensity, increase and diminish the current without even the slight shock caused by the addition of element after element; a resistance of 500 or 1000 ohms are inserted, the number of cells probably needed thus brought into action, and the intensity gradually attained by decreasing the resistance in the rheostat; for the breaking of the current the resistance is increased until it surpasses the intensity of the elements in the circuit.

The first sitting should not be continued beyond five minutes, the current remaining at its height three minutes, then being slowly reduced. Currents of 200 milliampères I have continued for eight minutes in later stages of the treatment. During the passage of the current the operator must constantly observe both his galvanometer and the patient. The needle should remain perfectly steady; during the first minute it will show an increase of a few milliampères, but there must be no oscillation which indicates jarring or shock. The face of the patient and the galvanometer must be constantly observed, and the operator must be on the lookout for any evidence of irregularity: a momentary contact of sound and speculum would produce a terrific shock. If the bare sound should touch the vaginal membrane it would burrow its way and leave a grayish bed; if the thighs touch the edge of the abdominal plate, which must always be covered by the overlapping conductor, an intense burning is experienced; if not so covered, a shock; and these shocks are trying, if not dangerous, with such intensities. The most intense shock is caused by a carelessness of which no one who ventures upon this treatment should be guilty, the sudden breaking of any one of the connections in the circuit, the dropping of the rheophore from the binding post at the battery or from the electrode, or the moving of one of the switches of the battery. In a portable battery, especial care must be taken lest disturbance be caused, the slightest jar of the battery causing undulations of the current and shock. At the point at which the stylet is inserted a grayish-yellow foam will accumulate, its mass depending upon the intensity and duration of the current.

After the full intensity has been attained and continued as long as it seems necessary, the current is slowly reduced from cell to cell, with the utmost evenness and gentleness, and the circuit opened when at 0. If the patient be very sensitive we may diminish the current by slowly increasing the resistance by the water-rheostat. When the current has been broken the rheophores are detached and the active inter-pelvic pole is first removed, with the utmost caution; the abdominal plate is then taken off, the speculum inserted, and the vagina cleansed.

I am in the habit of dusting the cervix with iodoform and inserting a tampon of salycilated or borated cotton; in case of puncture I use the styptic iron cotton directly upon the point of attack, and pack it firmly to counteract the possibility of hæmorrhage as far as possible. The patient should then lie down or go to bed, if at her home, and if not, as soon as she reaches it; but in all events she must rest in the office long enough to thoroughly dry her garments, which are more or less moistened by contact with the electrodes, notwithstanding all care. In cold weather this precaution must be invariably observed, as serious injury may follow neglect. A twenty-four hours' rest is generally all that is needed, but in individuals more susceptible it is well that they use the ice-bag upon the abdomen and remain in bed several days. The inflammatory swelling which sometimes follows is thus best counteracted and most rapidly reduced; but even when it does occur, I have never seen it accompanied by constitutional disturbance or elevation of temperature.

The puncture should, if possible, be made through the cervix into the mass of the tumor; if the first is above the os, the next should be below, followed by one to the right and then to the left; if this is not well feasible, we seek the point of greatest projection, toward the vagina, avoiding the peritoneum. In some cases a gush of blood, very profuse while it lasts, but not of long duration, may take place within the ten hours following the application, and the patient must be forewarned, that she may not be alarmed. The firmly packed iron cotton tampon is the best preventive, but the hot-water injection should also be recommended, as the patient will be much better satisfied to have some means at hand to counteract this apparently threatening symptom.

I have entered so fully into the mechanical details of the treatment to recall them distinctly to mind, as they are absolutely essential in these cases, and will serve as a guide in all other applications, and once understood I need not enter again and again upon the same points.

We must always warn the patient of what is coming; we must first apply the dispersing electrode to the abdomen, thoroughly moistened with warm water; we must have the intra-pelvic electrode aseptic, and introduce this with the greatest possible gentleness; we must thoroughly insulate all but the active portion of the instrument, avoiding metallic contact with vagina, vulva or speculum, and never establish the current until all intra-pelvic disturbance has ceased, always increasing the current very gradually, avoiding all pain at the site of the active pole, bearing in mind this most important and invariable law in gynæcological electro-therapeutics, that *the intra-uterine or intra-pelvic pole must never cause pain*; in fact, *should not be felt*; upon the site of the abdominal dispersing pole the burning can be lessened by increasing the size of the electrode. All shock must be avoided; the connections made before the current is established, and not severed until after it is broken.

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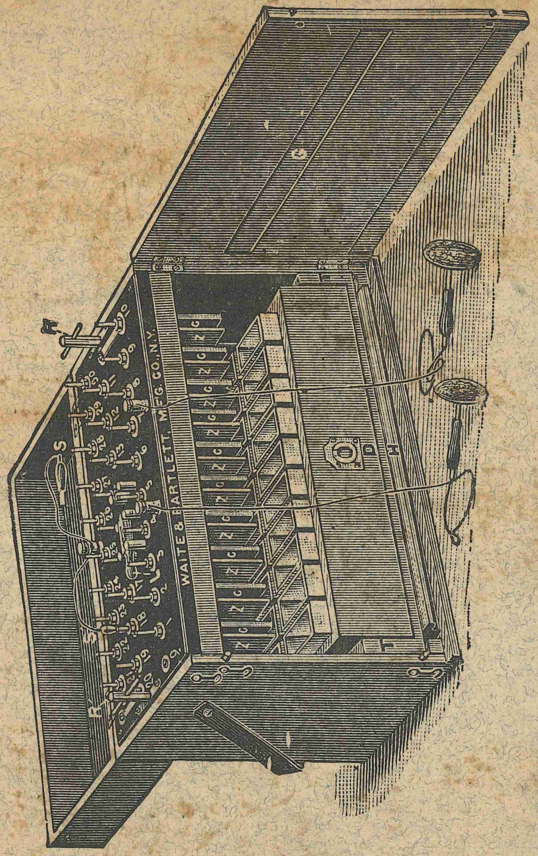
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BY GEORGE J. ENGELMANN, M.D.,
OF ST. LOUIS.

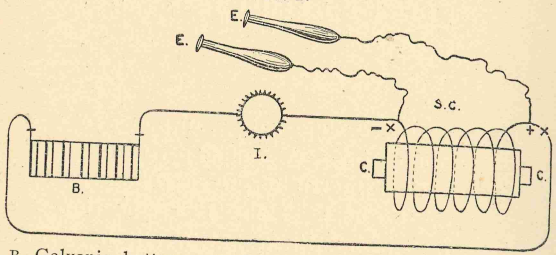
THE interrupted high-voltage primary or mixed current is one of the results of experiment with my new independent interrupter, devised for my faradic apparatus, but to be used also in connection with any galvanic and faradic apparatus; it has proved to possess an individuality peculiar to itself and of great physiologic efficiency, so that I am convinced of its therapeutic value and present it for the consideration of the profession.

This current, which I term the *interrupted high-voltage primary*, or *mixed*, current, is obtained by the interruption of the galvanic flow passing through the secondary coil of the faradic apparatus, and is taken from the terminals of that secondary coil, here used as a primary, which is of higher voltage, of many more winds and greater resistance than the ordinary primary in medical induction-instruments.

The current so obtained is hence not precisely identical with the primary faradic, and may properly be termed a *mixed* current, if not an *interrupted* primary of higher voltage.

A well-regulated, controllable interruptor is above all necessary.[1] Any galvanic battery may be used; one pole is connected with the interruptor, and through this to one of the terminals of the secondary coil of the faradic apparatus[2] (the binding-post from which the secondary current is taken); the

FIG. I.



B. Galvanic battery. I. Interrupter. S.C. Secondary coil. —X and +X. Terminals of coil. C. Core and primary coil. E. E. Electrodes.

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[1] For slow interruption, simple muscle-stimulation and massage, the interrupter ordinarily connected with a complete galvanic apparatus may be used, or, for rapid interruption, a commutator attached to the shaft of a motor, but precision is necessary, and ere long the perfected instrument, which has been devised and constructed by Messrs. Waite & Bartlett in accordance with my suggestions, will be in the hands of the profession, and accurate work, record, and comparison of results will then be possible.

[2] Not every faradic apparatus will answer, as most instruments have but a single coil and this may give a very unsatisfactory mixed current. To obtain the various therapeutically serviceable phases of this current an induction-apparatus, with a graded set of coils, is necessary; but if it has but one secondary coil it should be of approximately 1800 W. and 13 ohms R., or of about 800 feet of 22 wire, as this develops the most generally useful form of the interrupted high-voltage current, the painless muscle-permeating current.

other pole of the galvanic battery is connected directly with the remaining terminal of the secondary coil, and with these same two terminals the rheophores carrying the electrodes are connected.

A current so produced combines the characteristics of the galvanic and the induction flow; it has the same galvanometric quantity and the same chemic effect as a simple galvanic current of the same intensity, or, from the same number of cells applied in the same manner *plus* the voltage and the physiologic effects obtained from the winds of the coil; coil and patient being connected in multiple, the resistance is diminished and the current increased, but increased in voltage rather than ampèrage—converted, I may say.

The *physiologic effects are peculiar*, and differ materially from those of any other form of electricity in medical use, the current combining, as it were, the quantity and chemic effect of the galvanic with the voltage of the faradic; the effects resemble most nearly those of the primary faradic, but are more powerful and indicative of greater quantity, most marked in their *action upon muscular fiber*, which is affected by this *as by no other form of electricity*.

A variety of effects are produced by the use of different current-intensities and different coils; yet while this current will undoubtedly be of distinct value in certain nerve-lesions, it will prove pre-eminently a *muscle*-current, as it contracts the muscle most perfectly, acting upon every fiber in the most marked manner, like a powerful interstitial or intercellular massage.

The character and effect of the current depend upon the following elements, which must be noted, as it is by a variation in these factors that the varying therapeutic results are obtained:

1. The number of cells or intensity of the primary battery-flow.

2. The resistance and number of winds of (the secondary) coil.

3. The number of interruptions.

4. The position of the secondary coil in reference to the core and primary.

5. The character and location of the electrodes.

1. The number of cells used or the intensity of the primary battery-flow determines the galvanometric measure and chemic effect; these being the same as from an ordinary galvanic current without insertion of the coil and applied in the same manner, it is evident that the character of the current must in a measure depend upon this factor; but as voltage and induction-effects are prominent, the number of cells to be employed is determined, not by the chemic effect to be produced, but by the coil to be used. Only one cell can be employed in connection with a short coil, the number of cells being increased with the resistance and number of winds in the coil; but more than ten or twelve cells, if in good condition, can hardly be used to good advantage, even with the long fine coils, at least on healthy tissues.

2. It is the coil preëminently which determines the character and effect of the current,[1] the resistance and

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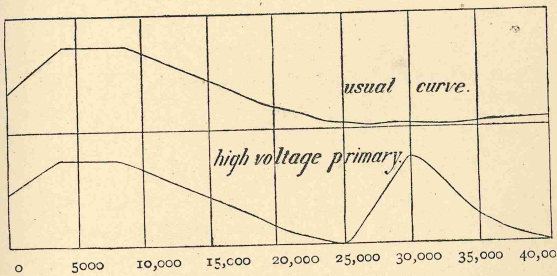
[1] In speaking of *the coil*, I invariably refer to the *secondary* coil of the faradic apparatus, in position on the instrument, *used as a primary* in this circuit.

number of winds materially varying its physiologic value, but not in precisely the same manner as when used as a secondary in the faradic current proper. The faradic current from a coil of high voltage, or many winds, has *least* quantity, whilst the mixed current from this coil is of necessity one of *greatest* quantity.

The lower the resistance of the coil and the less the number of winds, the more powerful the induction-effect and the less the quantity of the primary galvanic force to be employed: No. I coil (Engelmann), 0.8 ohms R., 528 winds, has an effect, both motor and sensory, too powerful for therapeutic use, even with one single cell of the weakest Leclanché.

FIG. 2.



No. II, the medium coil, 13 ohms R., 1750 winds, with one cell from any galvanic battery, produces the most satisfactory, deep, muscle-contracting currents, permeating every fiber. This is, *par excellence*, the coil which gives value to the current, and it is remarkable how completely it can be confined to a distinct muscle by the location of the electrodes; whilst permeating its fibers it does not seem to radiate beyond.

For the developing of the most satisfactory results, the number of cells used must be increased with the resistance and number of winds in the coil:

	Feet.	Wire.	Winds.	Number of cells found to be effective.
For a coil of	1500	36	4,000	4 to 5
" "	3000	36	7,000	7
" "	4500	36	10,000	9 to 11

By longer coils muscular contractions are likewise produced; but these are more painful, and the chemic effects of the galvanic current begin to assume prominence; these should prove efficient for other therapeutic purposes, when more marked galvanic effects are called for.

3. Change of relation between the secondary coil and the primary coil and core, *i.e.*, the moving to and fro of the coil on the scaled slide, varies the intensity of physiologic effect. This variation of intensity is similar to that of the primary faradic, but differs in some features; if coils of low electromotor force are used, the intensity of physiologic effect is increased by a sliding out of the coil away from the core; this is most marked in the coil of fewest winds, coil I, 528 winds; somewhat less so, but still very decided, in coil II, 1750 winds, 13 ohms R.; coils of higher E. M. F., longer; fine-wire coils, on the contrary, *weaken* the current-effect by the drawing out of the coil, or the moving away from the core; this is true, even of the coil of 1500 feet, or 4000 winds, and of the muscle-coil of fine wire in multiple, 6500 winds, and only 4 ohms R.

The true primary coil of the apparatus is ignored in these experiments, and its terminals are not connected. When this is done it acts as a damper, like the copper tube of Duchesne, to weaken the current.

4. The number of interruptions, or the rates of vibration, control the physiologic effect of this current, as they do that of the faradic, whilst the chemic and galvanometric action is affected but little and that in a contrary sense.

Interruption and alternation affect the physiologic action of this current in the same manner, but I shall speak only of interruption, pure and simple, as it is the interrupted primary which will prove of greatest therapeutic value, this being more agreeable, less painful and harsh than the alternating, and equally, if not more, efficacious as a muscle-contractor, so that the alternating primary will only be used when it is of importance that all chemic action be avoided. Both currents, interrupted and alternating, will respond to certain therapeutic indications; but as a simple muscle-contractor the more irritating and disagreeable alternating will find little favor as compared with the interrupted current; both, however, respond in precisely the same way, as regards physiologic effect, to variation in the rate of interruption.

Other conditions being equal, the same number of interruptions and alternations produce the same effect, *i. e.*, 10,000 interruptions have the same comparative effect as 20,000 alternations upon the current. As in the secondary faradic, the effect of the current increases with the rapidity of interruption from 1 to 2500 or 3000 per minute, and, after attaining a maximum effect, decreases with increased rapidity of interruption until a rapidity is reached with which all sensation ceases. Though the galvanometric effect is unchanged, the chemic effect increases; the more intense the current the greater the number of interruptions necessary to completely annul its effect.

Coil I, heavy, with one cell, causes powerful and painful contractions, too violent for general use with the ordinary rate of interruption; yet it ceases to have any effect, or to be felt, with 14,000 interruptions per minute (this when full in, over core, with small sponge electrodes to upper and lower arm, the effect depending greatly upon the moisture of the electrodes and the pressure upon them).

The 10,000-wind coil, 4500 feet of 36 wire, 11 cells, sponge electrodes to upper and lower arms, ceases to be felt at 25,000, whilst if only 7 cells are used, the same result is accomplished by 20,000 interruptions per minute.

The general law mentioned, of increase of effect with increase in rapidity of interruption, then decrease with still greater rapidity, holds good with one curious exception, true of the secondary faradic, as it is of the interrupted, or alternating high-voltage primary; and this interesting phenomenon, which merits a more thorough discussion elsewhere, I must here at least note: it is that currents from certain coils, as far as I have observed, from 5000 to 10,000 winds, 36 wire, under certain conditions,

after passing that rapidity of interruption at which they cease to be felt, *reappear* with greater rapidity, again *attain the previous maximum*, to again lose all effect with still greater frequency of interruption. In place of the simple rise and fall, there is a second shorter and additional curve of rapid rise to the previous maximum and fall to zero.

The 36-wire coil of 10,000 winds, with 11-cell primary galvanic force, ceases to be felt with 25,000 interruptions, then reappears, regains its previous efficiency at 30,000, and again weakens as the interruptions grow more rapid, to completely fade away as they attain a speed of 40,000 per minute; if fewer cells are used with the same coil, precisely the same phenomenon is observed, the same effects being produced by lower rates of interruption as the current is weaker.

5. That the character of the electrode, which determines penetration and surface-resistance, influences this current, as it does both galvanic and faradic, need hardly be mentioned; material, size, degree of moisture, location, and pressure upon the electrode, all serve to vary the sensation and effect of the current, and must be considered as determining factors.

This interrupted, high-voltage primary current possesses an individuality which must secure it a distinct place as a therapeutic agent; by blending the quantity and chemic action of the galvanic with the voltage and mechanical effects of the faradic we are enabled to produce peculiar effects; yet both are so modified that the resultant differs from a simple combination of these two forms of electricity. It differs from the painful interrupted or alternating galvanic as it does from the ordinary faradic, the secondary or induced current, and it will be resorted to when deep, penetrating effects are desired and when permeating muscle-currents are indicated; it will act, I believe, in those cases in which faradization fails. No other current, with such penetrating power, can be so localized and grasp every fiber of a muscle as does this.

Therapeutic effects I have not, as yet, been able to test, and cannot speak of its action upon muscle in central and peripheral lesions, but physiologic experiment indicates the powerful influence of this current, from proper coils, upon contractile tissue, and it is in this direction that investigation must first proceed.

In conclusion, a word of caution to the operator: Care must be exercised in the selection of battery-force and coils until a knowledge of the current and its effects is obtained. It is best to begin with the use of the lowest current-intensities, or the fewest galvanic cells which will take effect through the coil employed, or to use the number of cells here indicated as suitable for the various coils, varying the current by the pushing in or out of the coil, as the case may demand; when familiarity with the current has been acquired, this may be varied by variation in the galvanic flow for certain effects. It must be remembered that coils of low E. M. F., heavy coils of few winds, must be *drawn out* to *increase* the physiologic effect, whilst coils of higher E. M. F., the long, fine coils, vary less and in a different manner; these *weaken* by *drawing out.* It is also important to remember that the current-effect increases more distinctly than that of the faradic, with increase in the rapidity of interruption up to 3000 per minute, and, after attaining a maximum, gradually decreases with increased rapidity, decreasing in proportion to the current-intensity; the stronger the current the greater the number of interruptions necessary to reduce it.

A note must be made of the peculiar effect of fine-wire coils of from 5000 to 10,000 winds, which again attain a brief maximum intensity with increase of interruption after having been obliterated by a certain rapidity.

It is evident that this current is one easily obtained if a proper interrupter and a coil of suitable construction are available, as a single galvanic cell, Leclanché, Gonda, dry or red acid, will answer for use with the muscle-coil, the galvanic battery, or a larger number of cells, being needed only with the longer coils, which are not as generally useful.

I trust that an earnest trial will be given the interrupted high-voltage primary, which merits a place in our therapy, if only for its permeating muscle-effects, and I am convinced that therapeutic use will soon demonstrate the greater range of this efficient current.

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ELECTRICITY
IN
GYNECOLOGY.

BY

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[Reprinted from THE MEDICAL NEWS, January 25, 1890.]

GENERAL OBSERVATIONS ON THE USE OF ELECTRICITY IN GYNECOLOGY.[1]

BY A. D. ROCKWELL, A.M., M.D.,
PROFESSOR OF ELECTRO-THERAPEUTICS AT THE NEW YORK POST-GRADUATE MEDICAL SCHOOL AND HOSPITAL.

UNTIL a recent period the advances in the therapeutic uses of electricity were more especially along the line of those distinctively nervous affections that were neither specific nor structural in their nature. Cases of this latter type have always yielded but meagre results under electrical treatment, and I do not know that any competent authority seriously claims for electricity in most cases of structural disease of the central or peripheral nervous system, more than temporary and palliative effects. And yet those who, arguing on the side of their prejudices, or out of the fulness of their ignorance of the subject, ascribe to electricity a very low place in therapeutics, do so mainly on the basis of its failure to cure a class of conditions incurable by any method of treatment.

The statement that as a therapeutic agent "the effects of electricity are limited,'' must indeed seem a rash observation to those who have had repeated evidence of the wide range of its influence in the relief of nervous symptoms, and especially so to those who have witnessed the really remarkable relief so often afforded by intra-uterine applications of the galvanic current. When a man possessed of the experience of Keith, of Edinburgh, can say that many are prejudiced against electricity because they consider it quackery and know nothing about it; that his confidence in its power to relieve disturbing symptoms of uterine fibroids and to cure many chronic inflammatory conditions of the pelvis, continues to increase, and that he has no fear for the future of electricity, we have testimony that must greatly outweigh assertions and opinions that are purely negative.

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[1] Read before the New York Academy of Medicine, Section in Obstetrics and Gynecology, November 27, 1889.

In a recent and animated discussion of the subject at the Société de Chirurgie of Paris, equally favorable opinions were advocated by the majority of those engaged in the debate, and the strength of these opinions was accentuated by the fact that the majority of those who hold them are signally distinguished as laparotomists.

I do not propose here so much to give the results of my own experience in gynecological electrotherapeutics as to allude, and very briefly, to some points in the rationale of its effects.

I call attention first to the faradic current. Its effects are mainly mechanical, and according to the construction of the helix and the length and thickness

of the wire do we measure its action on the muscular tissues of the uterus. Applied directly to the uterus of animals in physiological experiments, the organ visibly contracts, although not to such an extent as the intestines, which, on application of the electrodes, can be seen to draw up gradually very much after the manner of a woman's work-bag. Its action on the smooth muscular fibres of the human uterus, when applied therapeutically is analogous to that of ergot, although manifestly more prompt and energetic, especially under the influence of the positive pole, which possesses a much greater power over the involuntary muscles than the negative. It is a current of alternation, of constant closing and breaking, hence it produces a sort of interstitial massage, heightening the activity of the circulation, accelerating absorptive processes, and influencing favorably the nutrition of parts.

Faradization, by its power over muscular contractions, sensibly increases temperature. According to the chemistry of the development of heat during muscular contractions, muscular work is the result of the decomposition of nitrogenous substances, and the muscles grow at the same time that they work and develop heat. That the value of the faradic current is more limited than the galvanic in the treatment of uterine disease must be immediately manifest to all who appreciate the difference between them, but in some conditions which come within the range of its physical and physiological activities, the faradic current may exceed in efficiency the galvanic. By its direct excitation of the smooth muscular fibres of the uterus we are enabled to combat that stasis of the circulation which is the beginning of uterine inflammation.

By this method we obtain a veritable interstitial massage that is potent in overcoming the primary inertia of the organ, and in preventing an arrest of retrograde metamorphosis, through which comes sub-involution with its inevitable and persistent sequelæ. In its purely local influence, then, faradization would seem to be preventive rather than curative, as it relates to uterine disease; or rather it is preventive so far as concerns the latter condition of uterine engorgement, and curative only in its initial stage. When the processes that go to make up the graver and more chronic diseases of the uterine parenchyma and its lining membrane have continued a long time, as is usually the case when medical interference is sought, the simple mechanical effects of the faradic current would be altogether misdirected.

Here we resort to the electrolytic influence of the galvanic current, or rather to what may be more fitly termed its galvano-chemical cauterizing effects through which are destroyed the granulations and fungoid growths of the diseased mucous membrane. By the interpolar influence of the current we correct a languid nutrition and hasten the absorption of exudations.

Just as the positive pole of the faradic current has an action of its own, superior in effect to the negative in causing uterine contractions, so the positive pole of the galvanic current has an action peculiar to itself. Here oxygen is generated and acids accumulate, which render this pole directly hæmostatic. It is, therefore, indicated in all hemorrhagic conditions, as well as where there exists an excess of the natural secretions. Owing, also, to the greater retractibility of cicatrices following positive galvano-cauterization, the results are more lasting in the treatment of fungoid growths, or vegetations, than could possibly be the case with the negative pole.

At the negative pole, on the contrary, the alkalies precipitate, imparting caustic properties and causing effects fluidifying rather than hæmostatic. The absorptive process is undoubtedly more active under this pole than under the positive, and is especially indicated in indurated chronic metritis and for the resolution of fibroids.

That the galvanic current often completely dissipates fibroid tumors of the uterus few will, I believe, affirm. In the treatment of scores of fibroids on the external surface of the body, I have never yet seen a single instance where one of them completely disappeared. As a rule, the reduction is comparatively slight, unless suppuration is excited, which may be easily done. External fibroids are simply unsightly, and for this reason we desire to be rid of them, and as it is not possible to obtain more than a reduction in size, the knife is to be preferred, and electrolysis has fallen into disuse. We treat uterine fibroids, on the contrary, not because they are unsightly, but because associated with them are a train of symptoms sometimes of the most distressing character. These symptoms can, it is believed, be relieved to a greater or less extent by electrolysis, and sometimes so completely relieved as to lead to the belief, so far as the patient is concerned, that the tumor has entirely disappeared. In the great majority of cases, however, it is simply a symptomatic cure. The tumor is still there, but reduced in size, and so far as pressure upon surrounding parts is concerned, or any hemorrhagic tendency, is entirely harmless. I am a firm believer in the great utility of the galvanic current in the thickenings and infiltrations resulting from inflammation of the pelvic cellular tissue. For the absorption of old exudations in other parts of the body, this treatment has long been used with excellent results, and in pelvic exudations the results are even better. I have seen the treatment, persistently carried out, result not only in the absorption of large pelvic deposits, but in the cure of the most obstinate and severe sciatica, and in the restoration of power to partially paralyzed limbs. In such cases, both sciatica and paralysis are caused, undoubtedly, by pressure upon the pelvic floor, and can be relieved only through the dissipation of the morbid products.

There are two methods of action through which we obtain results from electrolysis. The first and most apparent is the absolute destruction of tissue which takes place at the time of treatment. Some suppuration may follow, and thus, by an actual loss

of substance apparent to the sight, the tumor decreases in size. If, however, these were the only active forces in the electrolytic process, the method would lose much of its effectiveness.

If this be not so, how can we account for the many well-attested cases where morbid growths have entirely disappeared under simple external applications? Herein is the difference between the electrolysis of organic and inorganic substances. In the electrolysis of inorganic substances the effects cease as soon as the current ceases, the substances remaining in the condition that the current left them. The electrolysis of organic substances, on the contrary, starts a process that continues long after the current ceases to flow. Beside this subsequent effect, the current penetrates the tissue and induces various important changes beyond and beneath the eschar, and these combined agencies do far more, in many cases, to diminish the size of morbid growths and prevent further development than an actual destruction of a limited area.

A word in regard to the use of electricity for the relief of pain. No one can deny the excellent results that frequently follow the application of the galvanic and, indeed, of either current in uterine and ovarian pain, and as a somewhat extraordinary llustration of this I beg, in conclusion, to relate briefly a single case:

The patient was a married woman, aged thirty, and was referred to me, March 15, 1886, by Dr. J. O. Farrington, of this city, under whose care she had been for some time. She sought relief for pains in the ovarian region that were not only excessive, but most persistent, in spite of all efforts for her relief—including extirpation of both ovaries.

She had suffered more or less at each menstrual period for six or seven years, but for two years previous to the operation to which she had submitted, the pain had been so agonizing as to render her life absolutely unendurable. While the menstruation was scanty, it was nevertheless always on time, and continued during a period of nearly two weeks in a halting, irregular manner and with few intermissions. Everything attempted for her relief having failed, it was proposed to remove both ovaries, a proposition to which the patient eagerly consented, and, on the 3d of July, 1884, the operation was successfully performed by Dr. T. G. Thomas.

To the concern of all interested, however, the periodical appearance of blood still continued to some extent, associated with pains less acute, but still of a severe type.

The flow gradually disappeared, but the pains increased, coming on at regular intervals until, at the end of nine months, they were quite as distressing as at any previous time, and so continued until I saw her, through the kindness of Dr. Farrington, about a year subsequently. Under internal applications of the galvanic current, varying from twenty-five to fifty milliampères in strength, the paroxysms began to yield rapidly, resulting in a few months in a complete and what has been demonstrated a permanent recovery, for in the three years that have elapsed since the treatment was discontinued there has been no return of pain.

A very important practical question must immediately suggest itself to every one who reads the account of this case, as it did to the patient herself. If the treatment by the galvanic current had been attempted first instead of last, would it have been necessary to perform the formidable operation that she underwent?

While I cannot presume to answer this question, it is self-evident that an agent like the galvanic current, possessing such a marked influence over so many forms of pain of obscure origin, should precede rather than follow severe operative procedures for their relief.

THE TREATMENT OF CERTAIN PELVIC TUMORS BY GALVANO-PUNCTURE, DRAINAGE BY THE VAGINA, AND INTRA-UTERINE GALVANIZATION.

BY AUGUSTIN H. GOELET, M.D.,
OF NEW YORK.

I DESIRE to be understood, in the beginning, as referring only to such tumors as are easily accessible by the vagina for galvano-puncture, and to those which are so intimately associated or connected with the uterus as to be influenced by the chemical galvano-caustic applications to the endometrium, and trust that I may be pardoned for including under this caption pyosalpinx and hydrosalpinx.

The subject of aspiration and drainage by the vagina is not new, but it is a method which has been almost abandoned of late in favor of laparotomy and drainage through the abdomen. I believe, however, than I can present it in a more favorable light than has heretofore surrounded it. With our present perfected knowledge of antisepsis, there cannot possibly be the same objection to this outlet which formerly existed; besides, the addition to our resources of the antiseptic power of the galvanic current renders puncture and aspiration by the vagina harmless, when the condition is appropriate and the degree of penetration is limited. Apostoli says:

> "I have found that the galvanic current sent through culture media of pathogenic microbes is *germicidal*, which confirms what I said long ago, that this current was *antiseptic*, and would *attenuate* or *sterilize* certain conditions of germ growth."

This, then, is one explanation of the success following vaginal punctures and aspiration by this method. I refer more particularly to the method of aspiration and drainage of fluctuating tumors by the vagina, as described in the *New York Medical Journal* of June 8, 1889. And I think that the general good results which I have obtained justify me in preferring and strongly advocating this method of treatment, in certain appropriate conditions, in lieu of other methods now in vogue.

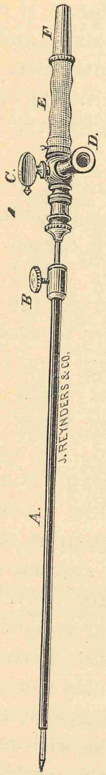
Dr. H. R. Bigelow, in THE MEDICAL NEWS, May 18, 1889, writing from Paris, says:

> "In the French Academy of Medicine they are discussing methods of drainage by uterus and vagina, without the necessity of operating, so that the minds of the surgeons themselves are turned in conservative directions. I am sure that the time is in the near future when electricity shall solve the riddle."

As there may be some who have not read the article to which I refer, I will briefly describe the method and the trocar and canula which I use. It is a very fine silver canula, the size being No. 4 of the French scale, with a steel trocar, and

covered with a slide of insulating material, which may be fixed by a screw to the shaft of the canula, so as to limit the degree of penetration. It is only capable of penetrating two centimetres, and it is seldom necessary to exceed one centimetre. The trocar is arranged for connecting with the battery, and the canula is made so as to be easily attached to an aspirator.

The method of application is simple; after deciding upon the degree of penetration necessary, the slide is fixed, and the trocar point is drawn within the canula. The vagina and vulva are douched thoroughly with a solution of bichloride, the index finger is introduced and, taking care to avoid any pulsating vessel, the most dependent point is selected. Then the canula, with the point of the trocar concealed, is passed along the finger until it impinges against the point selected, the trocar is pushed down into place, and the canula is made to penetrate to the limit fixed by the slide. The trocar being then withdrawn, if no fluid escapes, the slide is readjusted lower down, and the canula, without the trocar, is introduced a little farther. When the fluid has been evacuated, the trocar is partially reintroduced and connected with the battery, the circuit being completed by a large clay electrode on the abdomen or back. In hydrosalpinx, the negative pole is used through the canula, with not more than 50 M. for five minutes; but in pyosalpinx, the cavity must be washed out with an antiseptic solution, as an extra precaution, and I prefer the posi-



The cut shows a platinum canula and trocar (No. 4, French catheter scale) made for me by Mr. Reynders, for the galvano-tapping of pyosalpinx through the vagina. The shaft is covered with an adjustable sheath (*A*) of hard rubber for insulation. This may be fixed at any point by the screw *B* and the degree of penetration limited. At *C*, there is a three-way stopcock, and at *D*, a connection for an irrigator, as well as a socket for connecting with the battery. When the trocar *F* is withdrawn, an aspirator may be attached to the rubber tubing *E*, and, after the pus has been drawn off by a quarter turn of the stopcock *C* the cavity may be flushed with an antiseptic solution, passing in at *D* through the canula. By turning the stopcock straight again, the fluid is allowed to escape through the tubing *E* into the aspirator bottle. Care must be observed not to over-distend the Fallopian tube, the walls of which have been much weakened in some cases. That I may not be misunderstood, I repeat that I limit the degree of penetration usually to one centimetre, and deem the procedure appropriate only when the tube is close to the vaginal wall, full and tense, demanding immediate interference.

tive pole because it is less irritating, and is believed to be more antiseptic, using 50 M. for five minutes. When the positive pole is applied, a canula made of platinum should be used, as the silver would be acted upon and unnecessary irritation provoked.

The cauterization of the track of the puncture by the current shuts it off from the surrounding tissues and renders the absorption of septic material through that channel impossible, and by using a safe intensity, not exceeding 30 to 50 M. for five minutes, nothing unpleasant is to be apprehended. (The higher intensities necessary for fibroids are not to be thought of in these conditions.) The opening remains pervious a short time for drainage, and closes readily when it ceases, and if a dressing of iodoform gauze is frequently renewed in the vagina, there is nothing to be apprehended from that source. Resolution in the diseased tube is promoted by the influence of the current and is subsequently still farther favored by mild positive galvanism of the endometrium, which will likewise be appropriate for the coexisting endometritis. I limit this treatment by aspiration to such tubes as are close to the vaginal wall, and where fluctuation may be distinctly felt. These tubes are usually fixed by a mass of exudation.

In these conditions, Apostoli adopts a somewhat different course. He punctures with his ordinary puncture needle, and allows the pus either then or subsequently to drain into the vagina through the puncture. But it appears to me that the method here suggested is better, because it at once gets rid of the accumulation which is a constant menace to the patient as long as it remains, and the cavity is rendered aseptic and put in the best possible condition for resolution. Dr. Bigelow says he has seen Apostoli puncture a pyosalpinx, enlarge the opening, and insert a drainage-tube with good result.

This treatment of hydrosalpinx was suggested to me by the radical cure of three cases of hydrocele by the same method. They had repeatedly refilled after ordinary tapping, but never refilled after using negative galvanism through the canula.

Small cysts close to the vaginal wall have been successfully treated in the same way. I have found one application usually sufficient in these small cysts, when the fluid is drawn off first and a current of 100 M. to 150 M., negative, is used through the canula.

The fibro-cyst is sometimes more obstinate in yielding to this treatment, especially those lined with a secreting membrane. Some I have found to yield to one tapping and negative galvanism of 100 M. through the canula; but in other cases it has been necessary to make the application directly to the cavity. This is done by enlarging the opening with gradually increasing sizes of conical electrodes connected with the negative pole, until it will admit a bulb-electrode into the cavity. This bulb is fixed upon a small insulated shaft which is flexible, and through it a current of 150 to 200 milliampères is

concentrated within the sac. If drainage is not perfect through the opening, a rubber drainage-tube is inserted and fastened in position. A frequently renewed dressing of iodoform gauze is kept in the vagina.

I will cite one case here which will illustrate the success following this method of treatment:

The patient is married, and forty-one years old; one child at term, and one miscarriage. She has suffered for eight years at her menstrual periods with severe pain in the left side of the pelvis, radiating down the thigh, which often compels her to remain in bed for days at a time. Two years ago she was induced to visit the clinic of the Post-graduate School, where she saw Dr. Bache Emmet, who diagnosed a fibroid tumor the size of a quart bowl. She was placed under the care of Dr. A. P. Dudley, who offered to remove the ovaries. This she declined. She continued to suffer, growing worse all the time, the attacks of pain being more severe and their duration longer, so that never a month passed that she did not find it necessary to keep her bed for ten days to two weeks at a time, and, at the same time, keep under the influence of opiates. This was her condition in February last when she consulted me. I found the tumor to the left of the uterus, to which it was attached near the cervico-vaginal junction, and close to the vaginal wall. I also diagnosed a fibroid, and commenced treatment by galvanism. The intra-uterine applications were not well borne, so on February 26th, I made the first negative galvano-puncture through the vagina, using 250 M. for five minutes. This puncture was immediately followed by a discharge of an ounce and a half of yellow fluid, which caused me to suspect the cystic character of the tumor; but as it did not continue, and the tumor was very firm, I concluded that it was only a small cyst on the surface, which had been emptied.

March 5, the *second* negative galvano-puncture of 250 M. for five minutes was made. No discharge followed. Her menstruation appeared two days later, and there was much less pain than before.

March 12. Menstruation having ceased, the *third* galvano-puncture was made. This time the positive pole was used with 300 M. for five minutes.

April 10. The *fourth* galvano-puncture, negative, 200 M. for five minutes.

18th. The *fifth* galvano-puncture, negative, 200 M. for five minutes.

25th. The *sixth* galvano-puncture, negative, 200 M. for seven minutes.

A week after this puncture a copious watery discharge suddenly came from the vagina, and continued to flow away in gushes. Investigation showed that it had come from the last puncture-track. The opening was enlarged, and the sound could be passed up four inches into a cavity. All the fluid was drawn off, but the discharge continued for two weeks—as much as a pint a day.

May 18. A bulb electrode was introduced, and 150 M. negative galvanism applied to the cavity for eight minutes. Three days later all discharge ceased. She has had no pain since, and her menstruation has been normal. At the present time—six months since the last application—she is in perfect health. What remains of the tumor is about the size of a hen's egg. It gives her no inconvenience whatever. She has been seen recently by Dr. Dudley, who can vouch for her present condition.

The dermoid cyst may be treated in the same way as the fibroid cyst, when it contains only sebaceous matter, for the negative pole will soften it, and allow it to drain away. My experience is limited to one case in the pelvis, though I have succeeded in curing several on the surface of the body by this method. In this instance the tumor had been diagnosed as a small fibroma. At the first puncture a cavity was discovered, but there was no drainage from it. On enlarging the opening as before described, and exploring the sac, the nature of its contents was ascertained. Fifty milliampères negative galvanism were applied to the interior of the sac, a drainage-tube inserted, and a dressing of iodoform gauze placed in the vagina. This application was repeated every second day. Eight negative galvano-caustic applications were sufficient to empty the cyst completely. It soon ceased to discharge and healed up. Now, four months after, there is scarcely a trace of it to be felt.

I fully realize that such treatment could have no effect upon the bone, hair, and teeth often found in these cysts, but these might be removed through the opening if the tumor was situated close to the vaginal wall. In the case just mentioned the cyst contained only sebaceous matter.

The condition known as chronic pelvic cellulitis, which is usually manifested by a mass of exudation in one or both broad ligaments, including the tube and ovary, and associated with salpingitis and endometritis, yields very satisfactorily to galvanism of the endometrium. But it is very important to begin the treatment with a small dose—say 20 to 30 M.—for three to five minutes every second or third day, using the positive pole. And it is sometimes even better to begin with vaginal applications. The dose may be increased to 50 M. as tolerance is established. Later in the course of treatment it may become necessary to substitute the negative pole or vaginal puncture to hasten absorption. This condition dooms the patient to a life of misery, constantly threatened with peritonitis. Laparotomy does not always cure; but, by galvanism, she can be promptly relieved of pain, the deposit is softened and absorbed, the inflammatory complications are removed, and she is eventually restored to health with her ovaries and tubes intact and with a chance of conception. A case of this kind has recently come under my observation, and though it is only one of many others, some points in connection with it may be of interest here.

The patient had a miscarriage two years ago, and an attack of acute pelvic cellulitis in January last, from which she recovered partially, so as to be able to go about, but always suffered great pain in the right side of the pelvis on standing, walking, or riding. Frequently the attacks of pain were so sharp as to send her to bed for several days, especially at the menstrual period. In the beginning of October she

visited a clinic in this city, and was told that she had a tumor which was liable to burst and cause her death, and that it must be removed without delay. Careful examination, under chloroform, shortly after, when she consulted me, failed to reveal anything except a firm mass of exudation surrounding the right tube and ovary, and a retroflexed uterus partially fixed. The mass was extremely sensitive to touch, and the patient could scarcely walk a block. Treatment was begun with 30 M. positive galvanism, intra-uterine, three times a week, and the dose gradually increased to 60 M. She ceased to complain of pain after the sixth application. At this date she has had ten applications, and her improvement is marked. She can walk or ride any distance without pain or inconvenience, and is able to do her own work. The mass is less than half its original size, and not sensitive to ordinary pressure.

All of these cases, however, especially those of long standing, do not yield so readily to the intra-uterine applications alone, and it is then necessary to resort to vaginal galvano-puncture as advised by Apostoli. He uses a very fine needle, adjusted so as to penetrate only a half centimetre, using fifty milliampères, positive, for five minutes. I have seen marked benefit follow such punctures, both in my own cases and those which I saw treated at his clinic. The patients themselves remark the increased benefit following this form of treatment. It may be more painful at the time, but the result, they say, outweighs the pain of the application.

The intra-uterine chemical galvano-caustic applications exert a decided influence upon fibroid tumors attached to the uterus, but which are not accessible for vaginal puncture, especially if they can be treated by including the growth between the two poles for the interpolar action. Dr. J. H. Gunning, of this city, tells me that he has had remarkably good results from the interpolar action of the current alone.

It would seem unnecessary to add further testimony in favor of the treatment of uterine fibroids by electricity, since such authorities as Spencer Wells and Thomas Keith have abandoned hysterectomy and openly avow themselves in favor of Apostoli's method. But there are some who refuse to be convinced, and some who, having tried it improperly and failed, are unwilling to admit that any good can come of it.

As to fibroids,[1] it does not always dissipate the tumor entirely, but the size is very materially lessened; its growth is arrested, and the symptoms are relieved. The pain is promptly lessened, hemorrhage is absolutely controlled, and, as the tumor becomes reduced in size, the pressure symptoms are likewise removed.

It sometimes requires a great deal of patience on the part of the physician, as well as the patient, and strong confidence in the agent, to make both hold out to a successful end. Thomas Keith truly says:

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[1] Dr. Goelet stated that as others would discuss the subject of electricity in fibroids at the same meeting, it would be unnecessary for him to enter into it in detail.

"Apostoli's method, though slow, requiring much patience, tenderness of manipulation, and thought, is still sure in its results."

He also adds of electricity:

"My confidence in its power to relieve disturbing symptoms of uterine fibroids and to cure many chronic inflammatory conditions in the pelvis continues to increase, and I have no fears for the future of electricity. . . . Hysterectomy, remember, which is performed every day for a complaint that rarely of itself shortens life, kills every fourth or fifth woman who is subjected to it. This mortality must cease; it is not a question of surgery, it is a question of humanity. Every time that any disease can be cured without resorting to a bloody and dangerous operation, such as hysterectomy, progress is made in our art, and there is a gain to humanity, while surgery is the better of being purged of a deadly operation. Even the fact that in my cases of hysterectomy the removal of the uterus and ovaries was sooner or later followed by insanity in ten per cent. of the whole number, is enough for me to condemn any operation that removes these organs."

And this is the mature opinion of a most successful surgeon; one who was the first to lower the mortality of abdominal surgery.

The method of application should be more clearly explained and clinically taught in this country, for there are many to-day who have but a superficial knowledge of electricity, and some who are attempting to use this agent without even knowing the difference in the action of the galvanic and faradic currents, as well as many who do not realize the difference in the action of the two poles. This is a deplorable fact, but, nevertheless, true, as the following incident will attest:

A lady consulted me recently about a tumor which proved to be a fibroid growing from the right side of the uterus. She volunteered the information that she had no confidence in electricity, because her physician had been treating her for the past six months with that agent, and it had not only done her no good, but she was worse. He had told her that he did not himself think it was suitable for her case after he had given it a thorough trial. On inquiry, I learned that he did not possess a galvanic battery, but had treated her with a small faradic battery, even puncturing with that current. That man is prepared to denounce electricity as worthless. This patient has now been under my care since the middle of September, has had twelve positive galvano-caustic applications to the uterine canal, and one positive galvano-puncture. Previous to consulting me, she suffered constant pain, menstruated twice a month, and for seven or eight days profusely. She has had no pain since the sixth application. Her last period, which was twenty-nine days after that of the previous month, lasted only three days. She is now progressing nicely, can walk or ride without pain or fatigue, and the tumor is smaller and very much softer.

After giving Apostoli's method, as I understood it, a thorough trial, I thought enough of it to visit him during the past summer and learn more about it. It is a mistake to suppose that any one can apply this method without special preparation or

instruction. And I am now satisfied that Apostoli is but poorly understood by many who think they can grasp his ideas by reading his writings. It is necessary to see its practical application in order to comprehend it fully, and there is too much in the method to be learned in one or two visits to his clinic, even by those who understand electricity. A correct diagnosis is the first requisite, then experience alone will enable one to decide the course to be pursued, else the negative pole will be used when the positive is indicated, and *vice versa*. It is very necessary to understand the technique of the application and to have confidence to administer it properly, taking care that self-confidence does not overstep the bounds of prudence. Always respect the actual suffering of a patient, but do not be deceived by her nervous apprehensions. By knowing the condition, experience will tell you nearly how much of galvanism she can bear. Apostoli has pointed out that in fibroids there is a comparative insensibility of the endometrium to the current, and he also lays stress upon the fact of the increased sensitiveness of the endometrium in inflammatory conditions of the appendages. The fact being, that in all these last-named conditions there always coëxists an endometritis. But in uncomplicated endometritis the current is usually well borne. In treating diseases of the appendages, he says, begin always with the positive pole and a small dose and increase as tolerance is established. In fibroids, it is often possible to begin with 100 milliampères, and I have seen

200 used in the uterus without causing the patient manifest inconvenience. I have likewise seen galvano-puncture of 200 milliampères borne without much suffering when the pole used was positive. These and many other important points can only be appreciated by watching his work at his clinic.

I followed him closely while there, and came away more than ever convinced of the general utility of electricity in gynecology. One cannot but be impressed with the method of his work, his honesty of purpose, and conscientious painstaking toward his patients, as well as the courtesy extended the physicians visiting his clinic. He exhibits with the most perfect freedom the histories of his cases, the records of his treatment, and the results. Every case treated there may be examined and questioned by any one present, and, if you do not request it, you are invited to examine the patient and express your opinion. The notes of progress and the treatment are announced to all present, and recorded by his assistant, and one is at liberty to verify any statement that is made. Since I have seen for myself, I have been astonished at the statements made by others, which are so contrary to my own experience.

In conclusion, I desire to say that I do not think any one should condemn Dr. Apostoli or his method until they have visited his clinic and witnessed his work and his results.

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THE GALVANIC TREATMENT OF UTERINE FIBROMATA.

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I AM well aware that the above subject is one which has many times been written about, spoken about, and read about, and that there are few who have not already some idea of its utility; but there may be some who have formed opinions hurriedly or after insufficient trials, and as I welcome any additions to the literature on the subject, so have I ventured to hope that I could say something of interest to others.

It is needless for me to go into the history of this treatment of the uterine fibroid growth in detail, but as far back as 1871 Dr. Cutter had found the advantage of the continuous galvanic current, and since then many observers have been at work on it, and have from time to time published their memoirs on the subject.

There have been many different ways of applying the current to the tumor, all with the view of reducing its size and relieving the symptoms of this most unfortunate affliction; but I propose here to speak more especially upon a course of treatment which statistics and time have shown to be better in every respect than the others, viz., that first brought into prominence by its originator, Dr. Georges Apostoli, in an article read before the British Medical Association, in 1887.

He had then used it for five years, with most satisfactory results, and since that time he has steadily continued to study it in all its details, and reduce what had hitherto been a vague sort of empiricism to an exact science. This step in itself was all-important, for many had tried galvanism, with a large number of failures and only occasional successes, and of the latter no one seemed to know exactly why good had been done.

By the introduction of improved electrodes and a good milliampèremeter, however, we are now able to accomplish results entirely satisfactory to the vast majority of patients treated by it, and most gratifying to the attending gynecologist, and it is my firm belief that ere long its use will be universally recognized as the proper course to pursue before resorting to an operation the dangers of which we all know only too well.

Even to-day we come into contact with empiricism regarding the use of electricity, as it is practised by charlatans or those ignorant of its proper handling. I have been told by patients, of the faradic, interrupted galvanic, and static currents having been used on them for the cure of their fibroids, and one

told me not long ago that a female practitioner, supposed to be largely endowed with "natural electricity" (whatever *that* may mean), had treated her tumor with electricity by rubbing nearly all the outer layer of epithelium from her abdomen, and with the temporary relief which massage sometimes brings. Is it to be wondered at, then, that there are sceptics regarding its use?

Since my appointment as Electro-therapeutist to the Woman's Hospital several years ago, I have had abundant opportunity to test the values of the different methods of application, and have found the results of those cases treated by Apostoli's methods to be far better than the others. Puncture through the abdominal wall seemed to produce fair results in some cases, but I do not consider it as efficacious as Dr. Apostoli's method. Although the *modus operandi* of it is comparatively well known, a hurried description may elucidate much that follows.

He introduces one electrode, shaped like an ordinary uterine sound, into the canal, and the other, a moist pad of potter's clay, is placed upon the abdomen over a prominent nodule, if there be one, or at the upper limit of the growth, if it be rotund. These are then connected with the battery by the flexible conducting cords, one of which must reach the battery by way of the milliampèremeter, as the amount of current used is to be accurately measured. The current is then turned on, its strength increased very slowly and without shock, till the proper number of milliampères is reached, and is kept there from five to twenty-five minutes, depending upon the susceptibility of the patient, etc., and is then reduced in the same way, great care being taken to avoid any sudden break in the current, which would cause a shock to the patient. This method will answer for most cases in which the mass is situated in, or attached to, the fundus or anterior wall; should the situation or attachment be the posterior wall, galvano-puncture is resorted to, with a trocar-pointed electrode. Its application is as follows: A careful vaginal examination is made, and the posterior cul-de-sac thoroughly explored, any pulsating point being located, and avoided thereafter. When a spot free from pulsation is found, the end of a small celluloid tube is placed against it and the trocar-electrode, with the handle firmly screwed to the end toward the operator, is passed through the celluloid sheath and the puncture made to a depth not exceeding one to two centimetres. This celluloid tube answers a double purpose: that of insulating the needle from the vagina and of preventing the point from entering too far or beyond the distance intended and previously arranged for. Should much hæmorrhage occur when the needle is withdrawn, an accident I have never known to happen, a bivalve speculum can be introduced and forceps applied, or the positive pole be made to act as a hæmostatic.

This treatment is often administered without an anæsthetic, and the strength of the current should be no more than the patient can tolerate. It should also be remembered that the current itself, in two or three moments, has a distinct local anæsthetic effect, thereby lessening the pain and allowing an increase of quantity. A current of 30 milliampères has been found to produce benefit, and up to a certain point, stronger ones in proportion. I find that from 75 to 150 milliampères can be quite comfortably borne, and certainly produces most marked improvement.

While trying to get exact measurements of the tumor in every case, it is often extremely difficult to do so, owing to the presence of gas in the intestine behind the mass, to the thickness of the abdominal walls, etc. One thing that I have noticed is misleading, viz., that in some cases which have been treated by this method, as the tumor diminishes in size an increased amount of adipose tissue is found in the abdominal wall. This point should not be overlooked when external measurements are taken for comparison with former ones.

The *proper* use of the poles is of the greatest importance. To make a definite rule as to which should be used internally is impossible, as the nature of the symptoms will be our guide. In the class of non-bleeding fibroids, the *negative* pole is indicated for two reasons: first, because it seems to curtail the supplementary circulation by means of the rapid atrophy it causes, especially where puncture is made, and, second, because Dr. Apostoli has found that in bringing about a reduction of the mass, it is quicker. For the treatment of bleeding fibroids, the hæmostatic action of the positive pole has been too well proven to require extended notice. Not one single case of this kind which I have treated by the Apostoli method has failed to give the greatest satisfaction to both patient and myself. Cases have come to me nearly exsanguinated, and I have managed by this means not only to stop the hemorrhage, but, to my delight, prevent its return. Surely, had the treatment no other merits, this one in itself would entitle it to a fair trial before operative procedure is resorted to.

It is not my intention to claim any more than can be proved by many who are using it to-day, nor that a few applications of it will cure any and every fibroid with which it is possible for one to meet. That it is slow in its effects I know, and we must not be disappointed if marked diminution in the size of the mass is not noticed at once. The great majority of cases show little change under a month of treatment, which should be applied three times weekly. But I have found one (very rarely, two) thorough applications quite sufficient to control the most obstinate hemorrhage, provided a sufficiently strong current is used, and, what is *most* important, that every part of the endometrium be brought in contact with the electrode. This is sometimes very difficult, as the canal may be tortuous, and the stiff electrode then fails to touch some spot where there is bleeding. This may be provided for by the use of a flexible electrode, which is insulated to its platinum tip, which latter should be three-fourths of an inch long and shaped like a probe, but of

larger calibre. Having passed it to the entire depth of the uterus, it is held there, with one finger against the os, long enough to cauterize the parts in contact with the tip (the time to depend upon the strength of the current used), then gradually withdrawn, a very little at a time, till the entire endometrium has been cauterized. Should there be fungoid growths present, causing some if not all of the hæmorrhage, they will be destroyed at the same time, thus answering the purpose of curetting, and without leaving a fresh bleeding surface within the uterus.

All these measures should be carried out in a rigidly antiseptic manner, washing out the vagina with a bichloride or carbolic solution, before and after each application, and immersing the intra-uterine electrode in a saturated solution of iodoform in ether, just before introducing it. The ether instantly evaporates, leaving a thin deposit of iodoform on the electrode. Should germs even then be present, the current will be more than sufficient to destroy all life in them.

No new method of treatment is brought before the profession without its detractors. This I consider most fortunate, as it leads to discussions and narrations of cases which cannot fail to instruct us, and many interesting features are thus developed, which are of the utmost value.

One of the objections raised to the employment of the Apostoli method is the danger of a current strong enough to produce beneficial results. *Improperly* used, I grant that damage may be done;

but does a badly managed case of hysterectomy always get well? I would ask those who have made this objection to compare the results of the laparotomists with those who have treated an equal number of cases by this method; the latter will be found much less dangerous to the lives of the patients, to say nothing of the long convalescence, pain, possible mania, inability to continue in daily avocations, and hæmorrhage during or after the operation. The experience of such well-known gynecologists and authorities as the Keiths, father and son, Sir Spencer Wells, Woodham Webb, Playfair, and others in Great Britain alone, must certainly silence many objections regarding its inutility, while in this country, men of undoubted ability have met with results far beyond their expectations. Often the patients themselves can judge of their improvement quite as well as the attending gynecologist, for who knows better than they that the pain and sense of pressure, the dreaded hæmorrhage, the headache and backache so constant, as well as other reflex symptoms, are not what they once were? Who can tell better of the apparent loosening of the waistbands attached to their clothing?

I have now under my care a case sent me by Dr. T. Gaillard Thomas, through whose courtesy I am enabled to report it:

The patient was first seen by me in February of this year, and her history revealed the fact that she had noticed the enlargement in her abdomen four years ago; she had all the usual symptoms, including several most severe hæmorrhages, each of which had left her nearly bloodless. She was emaciated to an alarming extent, her pulse was weak, and she felt perfectly certain that the next hæmorrhage would be her last, and that she could not recover from the effects of a hysterectomy. Her tumor was situated in the fundus, and extended to the ensiform cartilage; her waist measured forty-four inches in circumference, and examination revealed that her uterus was five and one-half inches deep. Fortunately the canal was straight, so I had little difficulty in introducing the electrode, and thoroughly cauterizing the endometrium. I began treatment at once, and continued it with two intermissions of two weeks each, when she was obliged to leave town, and also during her menstrual periods, till my departure for Europe, the last of June, and did not see her again till on my return, October 1st. She has had no renewal of hæmorrhage; her tumor is now down to the umbilicus; is not tender, and gives her no pain; the canal is three and one-fourth inches long, and she can walk to my office, nine blocks from her home, three times weekly for her treatment, and can undergo the fatigue of a day's shopping with only a moderate amount of discomfort.

I could occupy the reader's attention with the narration of other cases were it advisable; but I feel that I cannot close this paper, already too long, without reference to an article written by Dr. Thomas Keith, of London, and published in the *British Medical Journal* of June 8, 1889. In it he says:

"What I now plead for is, that for a time all bloody operations for the treatment of uterine fibroids should cease, and that Dr. Apostoli's treatment, *as practised by him* [the italics are mine], should have a fair trial. Those who have hitherto most resisted the introduction of electricity are the surgeons who are best competent to carry it out. They are accustomed to manipulate in the pelvis, and they will not make mistakes of diagnosis, or make them as seldom as it is possible to do. Hysterectomy, remember, which is performed every day for a complaint that rarely of itself shortens life, kills every fourth or fifth woman who is subjected to it. This mortality must cease; it is not a question of surgery, it is a question of humanity. Every time that any disease can be cured without resorting to a bloody and dangerous operation, such as hysterectomy, progress is made in our art, and there is a gain to humanity, while surgery is the better for being purged of a deadly operation." . . .

"It may seem strange to some, that after the results I got in hysterectomy—results which almost make it justifiable—I should now begin to throw stones at the operation, instead of trying still further to improve upon it; and but for Dr. Apostoli, I should now be doing so. I would give something to have back again those sixty-four women that I did hysterectomy for, that I might have a trial of Dr. Apostoli's method upon them; and I would give something never to have had the tear and wear of flesh and spirit that these operations cost me, for in scarcely one of them was the operation simple.

"I have, in the meantime, said my say, and it must not be forgotten that the opinion here expressed as to the value of Dr. Apostoli's treatment is not that of an unsuccessful surgeon, but is the deliberate opinion of one who was the first to lower to a minimum the mortality that so long followed abdominal surgery, and who, by the best results yet obtained in hysterectomy—results that Dr. Playfair is pleased to call almost phenomenal—still retains that position."

What can I add after such an opinion as the foregoing? I can simply say that my experience with Dr. Apostoli's methods, while large, is more than satisfactory, and in quoting Dr. Keith's praise and thorough indorsement of it I have expressed my own views.

While abroad on business last summer, I was enabled to visit Dr. Apostoli's clinic and to satisfy myself on many points regarding his histories and statistics, and I earnestly advise all who can possibly make an opportunity, to see him at his work in the Rue du Jour, to do so.

You will be welcomed by a most charming and courteous gentleman, who will give you every possible opportunity not only to see him operate, but to examine his cases and their histories, talk with them, ask them any questions regarding their condition and treatment that you may see fit, and, in fact, satisfy yourself on every possible point of the truth of his assertions and the merits of his methods. You will also meet colleagues from Germany, Russia, Scandinavia, and the South of Europe, as well as many English surgeons of renown, a few South Americans, and, I am proud to say, a goodly number of our own countrymen; and nearly all have the same opinion as to the merits of Dr. Apostoli's treatment, and seek his clinic for further instruction.

In conclusion, let me urge upon the reader to give this method a *proper* and *thorough* trial before rushing his afflicted patient to the operating-room, there to undergo the dangers of the knife.

35 West Thirty-eighth St.

NOTES ON THE TREATMENT OF FIBRO-MYOMATA BY ELECTRICITY.

By A. H. BUCKMASTER, M.D.,
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THIS method of treatment has been before the profession for several years, and, while the consensus of opinion is decidedly in its favor, there are many who are disposed to deny its efficacy. The treatment requires patience, it is slow, and in cases where the tumor is treated solely on account of its size it is often impossible to gauge accurately slight variations. Constipation, flatulence, increase in adipose tissue, congestion or œdema, all are apt to mislead and perplex the observer. There are several means by which the sceptical may become convinced that the treatment is valuable.

First. By statements of individual observers, many of whom have not only claimed relief from symptoms and decrease in size, but also total disappearance of myomatous masses. The evidence of this class is most abundant.

Second. The testimony of individuals supported by the observations of disinterested witnesses. This can best be obtained in the hospitals, and a competent man should be invited to test the cases, who should be a thoroughly practical gynecologist as well as an electrician, and competent to recognize the contra-indications for treatment.

Third. The presentation of a reasonable explanation of the means by which the results are obtained. The explanation of the writer is founded on experiments on the non-striated muscular tissue of the dog's heart and on fibroid tissue outside of the body. The experiments were as follows:

The heart of an anæsthetized dog was exposed and a current of forty milliampères made to traverse a portion of the ventricle. A piece of the ventricle in the direct line of the current was excised and another some little distance from the direct influence of the current. When examined under the microscope the piece from the direct line of the current showed that the striæ had become markedly granular, while the piece outside of the direct line of current preserved the muscle cells unaltered. This granular appearance of the striæ would indicate degeneration of the muscle bundles. It is observed in fatty degeneration, and in such cases the contractility is much impaired. This is the first evidence of absolute molecular disintegration of living cells by the interpolar action of the galvanic current, where such process is confined to the cells.

The condition of rigor mortis is readily induced in a muscle through which circulation is maintained. The action of heat at 118° F., distilled water, acids even of the weaker kind, such as carbonic acid, bring

it about. If death rigor occurred in any considerable part of the muscle tubes of the tumor there would result a marked diminution of its irritability, for it is a well-known fact that muscle under this condition ceases to respond to stimuli. To determine if this was so after treatment the following experiment was resorted to:

It is assumed that the contractions of the uterus are followed by contractions of the vagina which are in direct proportion to them. Kehrer[1] found in his experiments with rabbits, that exposure to air would give rise to a contraction which advanced through the whole genital canal, while by chemical, mechanical, electric, and thermal irritation contractions could be started at almost any point and were transmitted in one or the other direction, so that an increase in the vaginal pressure would indicate a contracted condition of the uterus. This method of indicating contractions of the uterus has been utilized by Milne Murray,[2] of Edinburgh, in his experiments on the effects of hot water on the uterus. The following method was adopted by the writer: A rubber bag by which the vaginal pressure is to be determined is filled with water and communicates by a rubber tube with the proximal arm of a U-shaped glass tube which contains mercury. The other arm of the glass tube is opened at the end.

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[1] Chadwick: Peristalsis of the Genital Tract. Trans. of Amer. Gyn. Soc., vol. x.

[2] Edinburgh Med. Journal, Aug. and Sept. 1886.

When any pressure is made on the bag the column is pushed back, and this raises the discus of the mercury in the distal arm. The variation can be read by means of a graduated scale. The chief sources of error in using this means of measurement arise from having air mixed with the water, or having the tube of such thin rubber that it readily becomes distended by pressure.

There are two methods of measuring the effects of stimuli on muscular contraction; one is by observing the comparative strength of the contraction, and the other is by ascertaining the smallest amount of current that will give a contraction; the latter method was in this instance adopted. The induced current with a sliding induction coil was used. The cell used was a constant one. The patient in position, the electrode was placed in the uterine canal. The bag filled with water was then introduced, and after waiting five or six minutes for the vagina to become accustomed to it, the faradic current was very gently turned on (the other arrangements being exactly similar to those used in the ordinary treatment) until contractions were induced in the uterus. The amount of this current was carefully calculated. The constant current was now gradually substituted by means of a rheostat until sixty milliampères were registered. In about a minute the column of mercury showed an increased vaginal pressure of one-sixteenth of a pound.

The current was turned off very gradually, and the patient allowed to remain perfectly quiet for twenty minutes; at the end of this time the slightest induced current that would give a contraction was considerably less than before the treatment.[1]

The above experiments only point out a line of investigation. The writer has not had the time to repeat and test them as should be done; he merely indicates from the standpoint of the clinician what the laboratory worker may establish or disprove. So much for the interpolar action. In regard to the action at the poles it must not be forgotten that slight traumatism of the cavity of the uterus has an important effect upon the nutrition of the fibroid, and that there are many cases where fibroids have spontaneously disappeared. Gusserow states that various operative procedures, sponge-tents, incision of the mouth of the uterus, and intra-uterine injections frequently cause sloughing of fibro-myomata by interference with nutrition from traumatism of the uterine mucous membrane.

It is not my intention to narrate the histories of my cases, which present nothing brilliant in the way of cure. In no case has there been lack of improvement, in no case have I seen disappearance of the fibroid.

In regard to the technique of the operation there has been but little improvement of late. The literature of the subject is, and has been, overburdened with descriptions of visits to Apostoli and of his methods. A thorough knowledge of French is necessary to form any adequate personal opinion of Dr. Apostoli's work, or to comprehend the statements of patients, and this requisite must present an insurmountable difficulty to many of these witnesses.

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[1] Unfortunately the writer has been unable to repeat this experiment, but hopes that others may do so.

To Dr. Austin Goelet, of this city, is due a cheap and efficient electrode with which many electricians are familiar. One fact has, I believe, escaped attention in stating the dangers incident to these cases, and that is, chronic renal disease. Not only should the urine *in all cases* be examined for albumin, but the amount and specific gravity should be carefully considered. The writer has seen this complication assume most serious importance, and it should never be overlooked. In closing these brief remarks I desire to say that I believe that dissatisfaction in the treatment is usually due to failure in understanding and carrying out the principles enunciated by Apostoli.

207 CLINTON STREET, BROOKLYN.

BI-POLAR FARADIZATION IN GYNECOLOGY.

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ELECTRICITY is such a new subject and its different departments are so numerous that it is no easy matter for all of us to keep pace with its progress.

As is generally known, it was Faraday who discovered that an induced current of electricity is set up in a conducting wire which is placed near to, but not touching, another wire through which a current is passing. It is also well known that the appreciable effects of the passage of a current of electricity, either direct or induced, are greatly increased by the interruption of the current. Thus a continuous current of a hundred milliampères can easily be borne, while if the same current be interrupted it will promptly knock one down. By making the primary wire into the form of a coil and placing a piece of soft iron within the coil the iron becomes magnetic whenever the current passes, and this body of magnetized metal in turn intensifies the current in the primary coil. The primary coil should be made of moderately coarse wire so

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as not to offer too great a resistance for the battery to overcome, as the battery, which should consist of two closed cells in a separate portable case, must have sufficient electro-motive force to push through the coil. The secondary or induced coil deserves special attention because it will depend entirely upon the shortness and coarseness, or the length and fineness of the wire, whether you will obtain those almost magical effects which some have claimed for it. There are many who cannot believe that these differences are of any real consequence, and yet there is no fact in medicine of which I am more certain than that the results from these two wires are totally different. The coils which I have been using for the past three years are wound as follows: the short wire coil, which is about twenty-five yards long, and No. 14 or 16 in diameter, is insulated with silk and varnished between the layers. The fine wire is about No. 40, which is the finest made, and is about a mile long. The short, thick wire gives out nearly the whole quantity of current that is induced in it, and is, therefore, called the current of quantity, while the long, fine wire offers a tremendous friction or resistance to the passage of the current, and is, therefore, called the current of tension. I think this is a better name for it than current of *quality*, which it has sometimes been called. The current of quantity from the coarse coil, as has long been known, is an excellent tonic for muscular fibre, and I have used it to advantage in nearly every case in

which the symptoms could be traced to defective muscular contraction. It should be placed high in the list of tonic remedies, although I do not think that it possesses any miraculous virtues which are not possessed to a greater or less extent by gymnastics, regular exercise, strychnine, quinine, ergot, hydrastine, and cold and hot water. This much can be said for it, however, that it is a tonic especially suitable for relaxation of those muscles which, owing to adverse circumstances, cannot be toned up by any or all of the above mentioned means, and, besides, it can be made directly on the muscles or group of muscles which are most at fault. By means of Apostoli's bi-polar electrode it is especially applicable to the muscular organs in the pelvis. For instance, in post-partum hæmorrhage we can surely obtain instant and permanent contraction of the uterus, no matter how exhausted it may be, by introducing the bi-polar electrode and turning on the coarse wire current.

For those obstetricians who are frequently meeting with this accident, a small battery which can be set in action in an instant, might well find a place in the modern obstetric bag. I must confess, however, that I have never put it to this use, for, although I have been looking for a case on which to try it, since I have been giving nature a little more chance I find that relaxation of the uterus is more and more rare. I have had, however, many cases of subinvolution due to the defective contraction of the uterus, accompanied by the usual symptoms, and they have invariably been promptly relieved, and in a very reasonable time cured, by *séances* with the bi-polar intra-uterine electrode with the current of quantity as strong as the woman could bear it, and lasting ten or fifteen minutes. But it must be remembered that no such gratifying results will be obtained if the enlargement is due to fibrous tissue instead of muscle. Areolar hyperplasia, like fibroid, must be treated by the continuous current. Another class of cases with which I have had very gratifying results are those of deformity and displacement of the uterus, due to relaxation of its walls or of the muscles which hold it in the centre of the pelvis. The presence of strong adhesions, however, binding it down in a wrong shape or position, would diminish the probability, or even preclude the possibility of restoring it to its proper form or position. The cases in which I have been occasionally disappointed, were those in which the muscles of the uterine supports had undergone degeneration so long ago that there seemed to be little or no muscle left to work upon. In such cases I have abandoned this treatment for some more speedy one.

This treatment is not at all applicable to cases of bleeding due to fungous endometritis, or to the presence of retained placental tufts. In those cases it is our manifest duty to remove them with the curette or, in the case of fungosities, to destroy them with the continuous current. The coarse wire faradism, however, is comparatively well known, so I need say no more about it. The advantages of the bi-polar method are :

First. It is less painful than the old method because it does not require the current to pass through the skin, which is much more sensitive than the vagina.

Second. It is easier to apply because it dispenses with the need of an assistant.

Third. It allows a much stronger current to be tolerated.

Fourth. It is consequently more effective because the higher the intensity of the dose the more marked the effects.

These bi-polar electrodes are made with one pole at the extremity and the other separated from it by an interval of an inch or so of insulating material, so that the current has to go through the tissues to get from one pole to the other. In doing so, it seems to set up circles of induction in the neighboring structures, as proved by the following observation : when the current is started with a moderate strength from the fine wire coil the patient, if asked what she feels, will say that there is a numbness of about the size of a walnut. As you slide the secondary wire over the primary more and more, she will say that the area of numbness has increased to the size of an orange, and finally when the whole strength is on, the numbness will have invaded the whole pelvis, including the area of pain. This can only be accounted for, I think, by the fact that induced currents are set up in the successive layers of tissue, which in a way take the place of contiguous wires on the telegraph poles. These bi-polar applicators are made of several sizes; two or three for the uterus, varying from the diameter of the uterine probe to that of the ordinary sound; and as in certain cases, such as pregnancy, it may not be desirable to introduce anything into the uterus, there are several sizes made for the vagina. But one uterine and one vaginal electrode are practically all that are required. As a rule, the preference should be given to the intra-uterine applications because they are much more effective than the vaginal ones.

We now turn to a short description of the qualities, indications, and methods of application of the comparatively new, and in its effects almost magical, current from the fine wire. I have already said that it causes very little muscular contraction, but that it has the power of affecting the nervous system. The element of pain plays an important part in the diseases of women and very often exists where no organic lesion can be found. More especially is this the case with ovarian pain, a great many cases of which I have completely cured with less than a dozen applications of the fine wire faradism. How it does this I am unable to say. Apostoli thinks that it sets up vibrations in the nerves, travelling in an opposite direction to the ordinary or painful impulses. Perhaps the current of tension filling the nerve-fibres dams back the painful impulses, or perhaps the vibrations are so rapid that the conducting power of the nerves is temporarily lost; but I think that Apostoli's explanation is the best.

There are three kinds of cases in which I have found the fine wire bi-polar faradization remarkably beneficial. They are:

First. Ovarian pain where no organic disease could be found. I do not pretend for a moment that it would be of any use in even small ovarian cysts—the sooner they are removed by operation the better. When I see these on our society table I feel no regret that they have been removed; but when surgeons remove healthy ovaries on account of pain only, I feel sorry that they were not aware how easily that pain could have been relieved by fine wire faradism. The first sitting should last ten, twenty or even thirty minutes, if it is that long before the patient can say that her pain has gone; it is then well to tell her that she may expect the pain to return after a few hours, but that each day it will stay away longer and longer, until after a variable number of sittings, rarely more than ten, the pain will remain away altogether.

Second. In cases of abdominal pain due to hysteria it acts promptly, not only in rendering the abdomen insensitive to pressure but also in calming the general nervous crisis within a few minutes. This was one of the observations which struck me most at Apostoli's clinic, that women who could scarcely bear to be touched with a feather on the abdomen, could, after five or ten minutes of fine wire faradism in the uterus or even in the vagina, endure any amount of kneading and punching without the slightest discomfort. In fact, parts which before were hyperæsthetic had now become anæsthetic. This has caused the charge against Apostoli of curing such cases by means of hypnotism, but I feel sure that this is not the case, because he does not possess that strange power, and besides many of the patients were totally ignorant of the nature of the treatment and its effects. This tolerance of hysterical patients for the full strength of the current of tension has often made me think that my apparatus was not working, until I attempted to test it on my own hand, when I found it unendurable with one-fourth of the intensity which the patient could easily bear. On trying the same strength on well women you will also find that they cannot stand a quarter of the dose that an hysterical woman can.

As I have already said, the current must be increased gradually in all cases, but *very* gradually when the pain is of an inflammatory nature. In bringing an application to an end, it is necessary to turn the current off before withdrawing the electrode, for the simple reason that the passage of the current over the much more sensitive vulva would cause the patient to shriek, although she could bear the same amount of current in the uterus or vagina without feeling it.

Third. There are many women about the age of thirty who, though fleshy and apparently well supplied with blood, do not menstruate at all, or but

slightly. These women feel uncomfortable; their *embonpoint* makes them weak and they have many nervous symptoms which place them in the category of hypochondriacs. Anything that will bring on a full return of the menstrual flow gives them immense relief. I know of nothing that will attain this object more surely than three applications a week of the current of tension to the inside of the uterus, between the periods. Not only will the flow be reestablished, but the uterus, which before measured less than normal, will soon develop to its full size. I am aware that there are other means of doing the same thing, but none of them is so satisfactory as this.

Fourth. In vaginismus I have found it remarkably effective. The condition is due to hyperæsthesia of the nerve terminals about the entrance of the vagina, and is really a form of hysteria. In most cases the other symptoms of hysteria, as abdominal tenderness, etc., are present. In such a case the treatment may begin with one or two vaginal applications, after which it will be easy to introduce the finger and to use the intra-uterine electrode. In some cases the hyperæsthesia may be concentrated upon or limited to a small area as large as a ten-cent piece. The removal of the over-sensitive nerves has been recommended by Hilton for this often very intractable condition. Apostoli has devised an electrode for such cases in which the two poles terminate in two hemispheres of carbon placed side by side and separated by a thin layer of gutta percha. When this is placed on the hyperæsthetic spot the fine wire current is forced to pass through the tissues in order to get from one pole to the other. With this instrument the current can be localized on two or three over-sensitive papillæ. In the worst case of vaginismus I have had in twelve years the patient was cured by three applications and became pregnant at the next ovulation.

Besides these four indications Apostoli has advocated a fifth, with which I have had no experience, viz.: in pelvic pain due to inflammatory conditions of the uterus or its appendages. I have feared so to use it because of its well-known stimulating effects, although it is true that iodine acts in the same way in similar conditions. Those who wish to try it will do well to remember Apostoli's warning not to push the strength of the application beyond the point which can be easily borne, while, on the other hand, in pelvic pain of non-inflammatory or hysterical nature it is sometimes an advantage to push the current rapidly until its full strength is turned on.

There are also some troublesome conditions of the bladder in which I have used bi-polar faradism with advantage, but which I have not the space to describe.

Before closing, I wish to disclaim any intention of considering bi-polar faradism as the only remedy in gynecology. Many of the conditions which we are called upon to treat are the natural outcome of wilful or ignorant disobedience of the laws of health,

and bi-polar faradism will not allow women to break them with impunity. Neither should we forget that the genital organs are not the only organs woman has, so that while we are calming her pain with electricity we should at the same time be removing the unhealthy conditions of the body generally, on which often the local disorder depends. All that I do claim for it is that it is a valuable addition to our therapeutic resources, especially in those diseases of women in which other methods of treatment often fail.

REMARKS ON ELECTRICITY IN GYNECOLOGY AND A NEW PORTABLE GALVANIC BATTERY.

BY FRANKLIN H. MARTIN, M.D.,
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APOSTOLI'S method, which was promulgated less than three years ago, first astonished, then excited the admiration of the entire medical world. Astonishment was expressed at a method which recommended such extraordinary means, and which claimed such brilliant results. Admiration was excited by the brilliancy of the author's conception and the thoroughly scientific grounds upon which it was based.

The instruments of precision introduced and made necessary by Apostoli's method have enabled us not only to prove or verify the value of his work and to substantiate his startling assertions, but to go on applying the sound principles he has evolved to the relief of many pathological conditions peculiar to the female pelvis.

One of the most important points to settle after the introduction of the high dosage system of treatment was the question of generation of current. We were aware that the ordinary batteries in use would give a maximum current strength through the body, from hand to hand, of but from eight to ten milliampères. Certainly, then (forgetting in practice what we only know in theory), we could not expect to get 300 milliampères with the same instruments. We soon found, however, from practical experience, that we were mistaken and that the battery which gave a current of but eight or ten milliampères through the enormous resistance of the body from hand to hand, would give a marvellously strong one through the comparatively small resistance offered by the abdominal walls and pelvic tissue, with properly constructed electrodes. We now know that the resistance offered by these parts with the clay, or some form of substitute for the clay electrode, is less than 200 ohms instead of 2000, as was originally supposed.

Any battery may be used which will give a maximum electro-motive force of fifty volts, with but small internal resistance, which is without vibration, undulation, or interruption, which can be perfectly controlled by the operator, and which can be gradually increased from zero to its maximum strength, and the reverse, without interruption. This includes the ordinary open circuit battery cells employed for office purposes, ranging in number from thirty-six to fifty—according to their electro-motive force. The Leclanché, the Law, and the Diamond Carbon are usually preferred. For all work, except when puncture is required with small exposure of needle surface (thereby increasing the resistance) or

when extraordinary strength of current is required, the ordinary twenty-four to thirty cell zinc and carbon chromate of potash batteries, such as are manufactured by the Galvano-Faradic Battery Co., the Flemming, or the McIntosh Battery Co., are sufficient. My battery is the outcome of a series of experiments made with the end in view of bringing forth a small portable battery which would possess none of the objectionable features of the ordinary form and which would do the same amount of work as that required of the office stationary battery.

The cell is a form of the chloride of silver cell, of sufficient power to give an electro-motive force of one volt, and an ampèrage of $\frac{8}{10}$ ampère. So that a battery of fifty cells will do the same amount of work as thirty-six to forty Leclanché cells. A battery of thirty-five of these cells has done all of my outside work for a period of eight months, without change or renewal, and possesses greater working power to-day, because of decrease of its own internal resistance, than when I began. From experiments made with the battery it is estimated that it will run with ordinary use without recharging or without perceptible deterioration in strength from one and a half to two years. As the battery is free from action when not working, it will remain in active condition a length of time in direct proportion to the amount of work required of it. There are two sizes of this battery manufactured by the McIntosh Battery Co., of Chicago, one of thirty-five cells and one of fifty cells. The fifty cell battery will generate a current of 300 milliampères with the Apostoli electrodes or any of the approved modifications.

Next to the treatment of fibroid tumors of the uterus by galvanism, I have found the greatest satisfaction in treating inflammatory exudation in the pelvis. This includes all cases, from the simple thickening of one or both broad ligaments to complete fixation of all the organs of the pelvis, with a thick unyielding exudate matting everything together. All acute inflammation, except secondary points arising from the irritation of already hardened exudate, should have disappeared in these cases before treatment is instituted.

I speak advisedly, after a long experience with a large number of such cases, when I say that I do not believe that there is a case of the kind described which, if submitted to a persistent course of applications of strong doses of galvanism in the proper manner, cannot be cured. The exudate will gradually but perceptibly disappear, the pain from pressure upon nerve fibres and nerve points will rapidly diminish, sympathetic disturbances will be relieved, displacements caused by contracting bands will gradually give way, and the general mobility of the pelvic organs will return, while coincidently the general health is restored from the effect of the electricity on the general system.

The best results are obtained in these cases from comparatively strong doses of from 75 to 125 milliampères. The object must be, in applying the electrodes, to include between them, as far as possible, the area of greatest disease. This, occasionally, will admit the use of an intra-uterine electrode as the internal point of departure. When an intra-uterine electrode is employed, one of as large surface as practicable should be selected, to avoid undue concentration and cauterization, which would give rise to subsequent cicatricial contraction. In the majority of these cases, however, an intra-uterine electrode is not admissible because of the position of the exudate. In such cases it is necessary to employ a vaginal electrode so constructed that a thorough diffusion of the current is obtained, in order not to cauterize the mucous membrane of the vagina. For that purpose I employ an electrode composed of a slightly curved, insulated staff terminating in an exposed metal ball which is thickly covered with absorbent cotton moistened with water. By this simple instrument I can select any particular portion of the vagina required, with a soft yielding contact surface and thorough diffusion. The cotton is applied to the instrument by folding a thick piece over the metal bulb, and fastening it around the staff at its point of attachment with the metal by means of a small rubber band.

This instrument can be inserted with or without a speculum—more easily without, with the patient upon her back and the hips drawn near the edge of the bed or table. If a speculum is used, it should, of course, be withdrawn before the treatment is commenced. When the internal electrode is in place, it should be attached to the negative pole of the battery. Having previously adjusted the external abdominal electrode and attached it to the positive pole, the current should be gradually turned on, employing every precaution to prevent the slightest break or shock, until a strength of from 75 to 125 milliampères has been reached, the maximum strength tolerated varying between these figures with the varying sensibility of patients. The sitting should last from five to eight minutes, when the current should be gradually reduced to zero and the instrument removed. The treatment should be given every second day. The staff of the electrode is easily unloaded of its cotton by means of the dressing forceps, thus making it possible to observe perfect cleanliness. Cleansing the staff thoroughly, and the use of a fresh covering and fastening each time, of course, being imperative.

This treatment persistently carried out will accomplish exactly what I claim for it. It will not only absorb the slight exudations which merely produce thickening of the vaginal vault, but it will cause the rapid disappearance of large, well-defined masses situated in the broad ligaments or in Douglas's cul-de-sac. It will cause ovaries, large and tender from the irritation of inflammatory products, to assume their normal condition by removing the cause of the trouble. It will cause the disappearance of strong bands of adhesion, no matter where situated.

It has long been known that *mild* currents, persisted in for a long time, would slowly cause disappearance of superficial exudates, but it hardly held its own with the old treatment of iodine applications and the glycerin plug, owing to the time and cumbersome apparatus required. But a cumbersome apparatus *alone* is no longer a sufficient excuse to justify us in ignoring the rapid and complete results obtained with *strong* doses, and the other advantages offered by Apostoli's instruments of precision.

I am aware that many assertions of a fact do not carry the weight of a recitation of a series of well-authenticated cases possessing evidences of conscientious reporting and of independent verification. I can only say in self-defence, that I have a series of just such cases in preparation for publication, in which the diagnosis and, afterward, the results were verified in almost every instance by eminent gynecologists.

My experience in the treatment of fibroid growths of the uterus by electricity amounts, in round numbers, to two hundred cases. In that number of cases, not more than five failed to continue the treatment until results could be estimated. Of those who continued treatment and made a fair test of its value, up to the present time but three have failed to obtain relief. One of these was a large, soft, spongy, rapidly growing subperitoneal growth, with a suspicion of malignancy, in a patient who was so sensitive to the treatment as to be unable to receive a satisfactory dose. The second was a marked hæmorrhagic case of a submucous variety, composed of many centres of development, which repeatedly discharged itself in small masses from the uterine canal, until finally the patient became discouraged and ceased treatment. The third case which I have been unable to influence favorably is one of a large, regular subperitoneal variety, which I have persistently labored with by means of the vaginal galvano-puncture with remarkably strong doses. I am unable to account for the stubbornness exhibited in this latter case, and shall recommend surgical interference.

I am fortunate, considering the great number and variety of cases treated, to be able to record no deaths; my results, on the whole, have been exceedingly gratifying. About eighty-four per cent. are symptomatically cured, with an additional per cent. of actual cures. About fifteen cases are still under treatment.

My methods, except in unimportant minor details, are in direct imitation of my friend and master, Apostoli.

There were two varieties of cases that gave me a great deal of perplexity in my earlier work, because I could not find their counterpart in Apostoli's publications. The first was a large interstitial variety of fibroid with a marked hæmorrhagic tendency, in which the patient would not tolerate a strong dose. In these cases the uterine canal is of great depth, and the hæmorrhagic surface of necessity very extensive. In order to check hæmorrhage in such a case, a strong dose is imperative, unless some means

of concentration is employed. Of course, if the ordinary platinum sound electrode is employed, of sufficient diameter and length to cover the whole internal surface of the uterine canal, a current of enormous strength must be employed to get sufficient concentration at any given point to cause coagulation and change of tissue, so as to check hæmorrhage In other words, a certain intensity is required, and the intensity is in direct proportion to the strength of the current and in inverse proportion to the area of the electrode. As it was impracticable to employ a dose of more than from 100 to 200 milliampères in many cases, on account of peculiar sensitiveness, I devised a means of internal concentration, or of limiting the area of the electrode.

A series of experiments, which I have already mentioned in an article read three years ago at the International Congress, proved that a current of twenty-five milliampères was necessary on an average for each square centimetre of internal surface, exclusive of the positive platinum electrode, in order to accomplish coagulation sufficient to check hæmorrhage. Upon that basis I constructed electrodes with a surface of four square centimetres, by means of which definite results were assured, and with which it was unnecessary to employ more than 100 milliampères current, different portions of the canal being treated in turn, at successive applications, until in time all have been covered. These electrodes are easily cleansed by means of a nailbrush and are constructed so that they will not be injured by strong antiseptics. Their flexibility alone is a great recommendation.

The other class of cases fortunately comprises but a small per cent. of all. They are distinguished by great sensitiveness and profuse hæmorrhage at the menstrual period. They tolerate but a small current and are even severely prostrated by the small dose they are able to bear. These cases, of course, cannot be expected to improve unless they are enabled to take a decided dose, and the nervous prostration is so severe when such a dose is forced upon them that it renders the treatment intolerable. A marked hysterical element is often present in these cases. The subsequent prostration is produced no doubt by strong reflex disturbances. I have found that they are readily improved if means are adopted by which powerful doses can be administered at not too frequent intervals, and at the patient's room where she need not be disturbed for six hours following treatment. I, therefore, get the dimensions of the uterine canal, and an electrode is constructed to fit it. I estimate its surface area in square centimetres, and estimate the strength of the current at twenty-five milliampères per centimetre that will be required at each sitting. I then order the patient to repair to her bed one hour before treatment, and to take a full dose of morphine and atropine. If I find, upon turning on the current, the patient will not tolerate the dose required, I ask an assistant to saturate a handkerchief with chloroform and give the patient just sufficient to enable

me to attain my object. When that has been reached, the chloroform can be withdrawn, the patient usually being able to stand the electricity after it has once reached its maximum strength. The current is then allowed to operate for ten minutes at the full strength required, when it is gradually withdrawn, and the patient instructed to remain quiet for at least six hours.

If it is not deemed prudent to give the opiate, chloroform alone, of course, can be employed; but I employ the opiate because, as a rule, the patient requires nothing more.

By this method I have repeatedly given doses varying in strength from 200 to 400 milliampères, and prostration seldom follows. The dose is repeated in from six to ten days.

THE TREATMENT OF CHRONIC METRITIS WITH GALVANO-CHEMICAL CAUTERIZATION.

BY G. BETTON MASSEY, M.D.,
OF PHILADELPHIA.

IN regard to this new electrical treatment of the diseases of women, I am of the opinion that a forward movement of vast importance has been initiated. So positive and striking is this progress that a degeneration into a fad is to be feared; but the fear of this should not blind us to important facts. During the last few years electrical science has itself been revolutionized, and it would be strange indeed if our better knowledge of it did not lead to the better application of this force to the medical arts.

Most authors have referred but little to one class of conditions in which I regard the galvanic current as possessed of an unique value. I allude to chronic inflammation of the uterus or of the endometrium. Theoretically, nothing could be better. In a convenient, clean, and controllable form we have an agent that will act as an alterative to the diseased membrane, and at the same time reduce interstitial hypertrophy by promoting both absorption and contraction. What other remedy promises as much?

In practice I have found that facts coincide very closely with this theory. I will give several brief illustrations:

A young married woman had been ill two and a half years, dating from a miscarriage. The symptoms were those of a chronic metritis with copious leucorrhœa from a capacious cavity three inches in depth. Fifty milliampères negative were applied intra-uterine for three minutes. Three days later she was better than for many months. After a second application the cavity decreased to the normal depth, and after a third she was completely cured.

Another case was that of a lady, aged thirty-one, who had been suffering from leucorrhœa and pain since a miscarriage, two years before. Examination showed a slightly lacerated os and a hypertrophied uterus pouring forth an abundant purulent discharge from a three-inch cavity. Two intra-uterine negative and one positive cauterization were given with a current of fifty milliampères, resulting in a prompt and complete cure.

Another case presented symptoms of both chronic metritis and parametritis. This woman was seen at the Howard Hospital Clinic in September last, with the ordinary symptoms of chronic metritis dating back three years to a miscarriage. The uterus was enlarged and indurated with a three and a half inch cavity and a peculiar hypertrophy of the anterior

lip. There were also decided fixation and tenderness on the right. She was given four intra-uterine cauterizations varying in strength from fifteen to forty milliampères. The result was a reduction of the cavity to two and a half inches plus, and the complete disappearance of a host of annoying symptoms.

In simple endometritis or uterine catarrh, galvanic currents locally applied are practically infallible. I have never seen a case resist them. The current strength need not exceed ten to thirty-five milliampères, using the bare intra-uterine electrode and an external indifferent pole of proper size. The choice of pole is governed by the presence or absence of menorrhagia, the positive pole being always used with this complication. When the endometritis is associated with slight cervical lacerations, it will usually be found unnecessary to perform the operation for repair, as all symptoms disappear under this treatment, leaving the patient practically well, even though a slight irregularity in the cervix remains.

REMARKS UPON THE USE OF ELECTRICITY IN THE TREATMENT OF FIBROID TUMORS OF THE UTERUS.

By ALEXANDER J. C. SKENE, M.D.,
OF BROOKLYN, NEW YORK.

In estimating the value of electricity in the treatment of fibromata I have, of necessity, been guided by the opinions of others more than by my own observations. Owing to the extremely conflicting testimony of those who have expressed themselves, it has been very difficult to get at anything definite.

One class of men has condemned this treatment without mercy. Another class has obtained the most perfect results—all that could be desired, in fact—and still another class has had an intermediate experience. They have been able to relieve their patients of most or all of their symptoms, and have diminished the size of the tumors or retarded their growth.

I have accepted the testimony of this latter class of witnesses because it apparently contained the most truth, and also because it agreed with what little experience I have had in my own practice. More than that, I have observed that those who avoid the extremes of praise and condemnation are gaining in numbers.

Time will not permit a full review of the arguments employed by those who are opposed to this treatment of fibromata, but it may be said that the strongest opponents are those who know least about electro-physics and the therapeutic use of electricity. They have not thoroughly tried it in practice, but have theorized about it and insisted that from the nature of electricity it could not affect neoplasms, forgetting that, in this, electricity is like many other therapeutic agents which produce most valuable effects, while we do not know how such effects are produced.

It has also been claimed that this agent is dangerous, but that has been fully met by the fact that all the benefit can be obtained without taking the risks that were at one time supposed to be unavoidable.

Scoffing and ridicule have been indulged in by a few, but they are signs of weakness in those who indulge in such methods of wrestling with questions in science, and may be passed without notice.

Perhaps the most important question in the whole discussion is the relative merits of this and other methods of treatment. The claims of hysterectomy and the removal of the ovaries for fibromata have been urged with great vigor by those who are strongly addicted to surgery. There is, however, no evidence that this kind of surgery is safer or surer in its results than electricity.

By a curious misuse of facts, it has been made to

appear that surgical treatment has advantages which it does not possess. Many cases are reported cured when they are simply relieved from the immediate effects of the fibroma and when, in fact, they are in worse health than before the operation.

I have tried to get records to show that more cases have died from removal of the uterus and ovaries for the cure of fibromata than have died from fibromata without treatment of any kind. If such are the facts—and I believe that the records of New York and Brooklyn would show them to be—surely surgery does not compare favorably with electro-therapeutics.

Add to this the cases that suffer ill-health after losing the ovaries and uterus, and the records of surgical treatment are not very largely in the interest of patients, though they may be in the interest of surgeons.

Certainly, the claims of electro-therapeutics are too well sustained to be put aside by any adverse arguments which have been advanced. In fact, the record of the treatment of uterine fibromata by electricity is remarkably good considering the short time that it has been properly used, and this leads to the hope that when it is better understood and more wisely employed it will gain more confidence.

Up to the present time it has, in its immature state, been competing with surgery, which has had the advantages of being perfected by long experience.

Great progress has been made within a short time. In a recent discussion in the Academy of Medicine of Paris it was shown that strong currents are not necessary; neither is it necessary to puncture the tumor in order to get good results. This enables us to avoid all dangers, hence is a great improvement in the art.

The science of electro-therapeutics has also been advanced greatly by the discovery of the action of the electric current upon tissue, as demonstrated by Dr. Buckmaster and confirmed by Dr. Van Cott, a demonstration which ought to silence all who have argued that such effects were impossible.

DISCUSSION ON THE USE OF ELECTRICITY IN GYNECOLOGY.

In the discussion which followed the reading of these papers:

Dr. P. F. Mundé, of New York, said that for a number of years he had been much interested in this subject of electrical treatment, and believed he had had ample opportunity to become acquainted with its practical working. He could speak most decidedly in favor of electricity as a therapeutical agent in gynecology, and had published his views on this subject in an elaborate article several years ago. He had seen more benefit derived from galvanism than faradism in gynecological practice. He had also found that mild currents used for a long time are, as a rule, more efficacious than strong currents employed for a short time. He used a Leclanché forty-cell battery. For ordinary purposes he used a small meter registering only twenty milliampères. He had another which registered 500 milliampères. This he had used a few days ago in treating a fibroid, and had found it faulty and untrustworthy.

With galvanism, placing the positive electrode next to the sensitive part in the pelvis, or on the abdominal wall, he had obtained excellent results in relieving the pain of chronic pelvic peritonitis. In old cases of inflammation with adhesions, with more or less pain in the ovaries and tubes, he had found that the tri-weekly administration of electricity, with the positive current internally, was a decided benefit after a few months of treatment. On the other hand, a number of patients, after several months of such treatment, had received no appreciable benefit whatever, and laparotomy had to be performed. This showed that electrical treatment was not suited to these particular cases. However, he deemed it proper in all circumstances to give patients every opportunity for possible benefit from electricity before subjecting them to a radical operation which, by whoever performed, could never be without an element of danger.

In obscure pelvic pain, due to an inflammatory deposit unrecognizable by digital examination, extending down the sciatic or crural nerves, he had seen instant relief follow the use of electricity after other treatment had failed. While he relied on electricity, and had found it of great benefit, especially in relieving pain, he thought it might be carried too far. He considered the length of time necessary to achieve satisfactory results was a great drawback to the use of electricity. If it was clear, however, that some good was being done, the time was, of course, not lost.

As to the milliampèremeter, though he had two, he was by no means satisfied that it was at all necessary, and was inclined to look upon it as a sort of plaything. When using galvanism for the relief of pain, the sensations of the patient, he thought, were a sufficient guide as to the strength of current to be employed; but when using the current in anæsthetized patients or for galvano-puncture, it was necessary to know exactly the strength.

The faradic current he had found very useful in amenorrhœa, intra-uterine faradization being employed three times a week for this purpose. He had used electricity but once in extra-uterine pregnancy, the interrupted galvanic current being the one employed. He had cured the patient, after nearly killing her by the shock. In pyosalpinx and pelvic abscess, laparotomy and drainage were certainly to be preferred to galvano-puncture. As to uterine fibroids, he had very decided views. He considered that the value of operative treatment in this class of cases was over-estimated. Out of 123 cases coming under his observation, about 50 per cent. had required no treatment whatever. 62 had required treatment, but only 8 of this number, in his opinion, had required Apostoli's method, and 4 others called for galvano-puncture. Apostoli's plan of treatment covered only the intra-uterine use of galvanism, with the clay electrode on the abdomen, the galvano-puncture being not strictly his method.

He had used the Apostoli treatment eight times in three years, and he could honestly say that while he believed it efficient for the removal of pain and the checking of hæmorrhage, and admitted that the patients felt better for its use, not a single tumor which had come under his notice had been much reduced in size. By galvano-puncture he meant puncture through the vagina, and this, in his opinion, was the ideal treatment for the cure of uterine fibro-myoma. The four cases in which he had employed it had been absolutely cured—that is, the tumors disappeared entirely, not a vestige being left. In one of the cases a single puncture gave rise to sloughing, and this sloughing itself destroyed the growth; in the others the cure was directly due to the effects of the electrical treatment. He was, therefore, a decided believer in galvano-puncture. At the same time, he believed it had its risks, and he thought it should never be employed at a physician's office.

Dr. Franklin H. Martin, of Chicago, exhibited a portable battery, and made some remarks upon the use of electricity in the treatment of certain pelvic diseases of the female (page 57).

Dr. G. Betton Massey, of Philadelphia, then said that Dr. Goelet's canula might itself answer as an electrode, which would have the special advantage of allowing the gas to escape through it. In speaking of the treatment of pelvic cellulitis, he said that in one case he had been using simple vaginal applications of the strength of seventy-five milliampères with very good results. In the use of electricity in gynecological practice he thought too much attention was paid to antiseptic washes. These were not necessary, he thought, if perfectly clean and aseptic electrodes were employed. Dr. Massey agreed with Dr. Lapthorn Smith in his explanation of the action of bi-polar faradization, but said he could not agree with him as to the use of the coarse wire as contrasted with that of the fine.

He could not agree with Dr. Mundé in his opinion of the milliampèremeter. He considered it of importance if more than five or six cells were employed. As to the sensations of the patient furnishing a guide for the strength of the current, he had seen as active a sensation caused by fifteen milliampères with the negative pole in the uterus, as resulted from 350 milliampères in other cases. In regard to the use of electricity in pyosalpinx, he had met with one instance in which the treatment for endometritis excited a flow of pus. He had reported the case to the Obstetrical Society of Philadelphia, and the patient had since then been quite well. The passing of the electrode in the direction of the left cornua of the uterus seemed to have been efficient in causing the result named.

Dr. Buckmaster read some remarks, prepared by Dr. A. J. C. Skene, of Brooklyn, who was prevented from being present (page 39).

Dr. H. J. Boldt, of New York, after speaking of the theory of the bi-polar action of the current on the tissues, went on to say that those gentlemen who absolutely denied any value to electricity were those who had never given it an honest trial. They had no right to operate on any patient until electricity had been given a thorough test. That it would not, however, in every instance even alleviate the symptoms he thought was perfectly true. As to pyosalpinx, he thought that these cases were cured when the tubes were cut out, and not otherwise. When the tubes were distended and the uterine extremities were closed, or when the tubes were agglutinated, what could be expected from electricity? All that could be done then was to remove the tubes by laparotomy. But as long as the calibre of the tubes remained patent, it was well to try everything. Many mistakes, he said, were made in diagnosis, and he thought it was not advisable to be too enthusiastic.

Dr. Goelet in closing the discussion, said he had cured at least thirteen cases by galvano-puncture, which otherwise could not have been relieved except by laparotomy—that is to say, the patients would otherwise have been mutilated; and he thought it was only right to try to cure these patients before mutilating them. By emptying the tubes and the use of the current subsequently, the tubes might be rendered patent. He thought that the pus could be first emptied, and then the removal of the cause of the accumulation of the pus effected. The resolution of the proximal end of the tube could be produced by galvanism of the endometrium, and he was very glad to hear that in this particular his experience had been confirmed by Dr. Massey in the case related. He did not think that we ought to say that the removal of the tubes was a cure of pyosalpinx. It was a mutilation, and not a cure, and in many cases, indeed, the patient's condition was more embarrassing after the operation than before.

He thought that many of the failures with electricity which Dr. Mundé said he had met with were to be attributed to the fact of his having used his currents too weak. Then, again, he thought that Dr. Mundé had made a mistake in regarding the milliampèremeter as a plaything. Many women would bear intense pain and say nothing about it, and electricity might be thus administered in dangerous doses. It was also impossible to estimate the particular resistance of the tissues in every case; and, for these reasons, the meter was always an important auxiliary.

THE CHAIRMAN asked Dr. Goelet whether his experience of intra-uterine galvanism had demonstrated to him the fact that an occluded tube had become patulous again, and was performing its function in a normal manner. He said that, of course, the fact of fecundation occurring did not imply that both tubes were functionating.

In reply, DR. GOELET said that he could only assume that complete recovery had ensued from the fact that all symptoms were completely removed, that menstruation became normal, and that there had been no reaccumulation in the affected tube.

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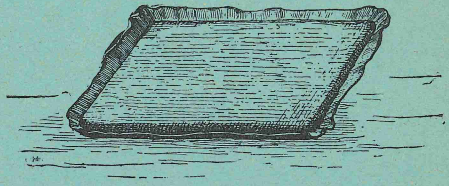

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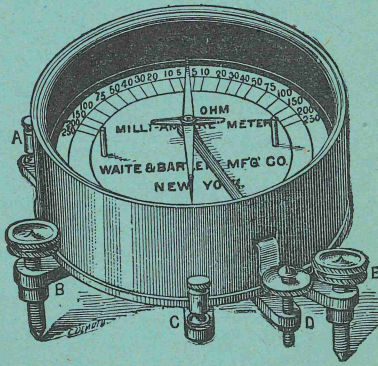

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